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# EXTENSION AND EDUCATION MATERIALS FOR SUSTAINABLE AGRICULTURE: Volume 2

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**EXTENSION AND EDUCATION  
MATERIALS FOR  
SUSTAINABLE AGRICULTURE:  
Volume 2**

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**A Project of the North Central Region  
Sustainable Agriculture Research and Education and  
Agriculture in Concert with the Environment**

**This material was prepared with the support of USDA Agreement no. 92-COOP-1-7266.  
Any opinions, findings, conclusions or recommendation expressed herein are those of the  
authors and do not necessarily reflect the views of the U.S. Department of Agriculture or  
the University of Nebraska.**



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# **EXTENSION AND EDUCATION MATERIALS FOR SUSTAINABLE AGRICULTURE: Volume 2**

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**A Project of the North Central Region  
Sustainable Agriculture Research and Education and  
Agriculture in Concert with the Environment**

**James W. King and Charles A. Francis  
Editors**

**University of Nebraska - Lincoln  
Lincoln, Nebraska**

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**January 1994**

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# **CURRICULA IN SUSTAINABLE AGRICULTURE**

**Developed by:**  
**Charles A. Francis and James W. King**

**Audience:** University faculty interested in curriculum for sustainable agriculture

**Objective:** To review actual curricula outlines in sustainable agriculture

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## **CURRICULA IN SUSTAINABLE AGRICULTURE**

**Workshop on Curricula for Sustainable Agriculture  
SARE Project, Lincoln, NE & Ames, IA**

- 1. Introduction to Curricula in Sustainable Agriculture**
- 2. Sustainable Agriculture, Agronomy 493/593 Course Outline, Ricardo Salvador (Iowa State University)**
- 3. Sustainable Agriculture, Agronomy 493/AG\*SAT, Ricardo Salvador (Iowa State University)**
- 4. Principles and Practices of Sustainable Agriculture, PSE 105, Matt Liebman (University of Maine)**
- 5. Agricultural Ecosystems, F&ES507a, Ricardo Russo, (Yale University)**
- 6. Agricultural Ecology, CRS 102, (University of California, Berkeley)**
- 7. Agroecology, ES130, Stephen Gliessman, (University of California, Santa Cruz)**
- 8. Agricultural Ecology & Sustainability, AGRI344, James O'Rourke (Chadron State College, Nebraska)**
- 9. Alternative Agriculture Curriculum, (University of Vermont)**
- 10. Sustainable Agriculture (B.S.), Bachelor of Science degree requirements and list of available courses, Matt Liebman (University of Maine); Faculty List from Maine.**
- 11. Environment and World Food Production, AnPl 3010, Steve Simmons, (University of Minnesota)**
- 12. Issues (Advanced) in Sustainable Agriculture, Agronomy 445/545, Ricardo Salvador, (Iowa State University)**
- 13. Crops, Soil, and Civilization, Agronomy 440, Bruce James and David Sammons, (University of Maryland)**
- 14. Masters of Science in Sustainable Systems, Tom DeLuca, (Slippery Rock University)**
- 15. Agricultural Ecology, PSE 445, Matt Liebman and Stewart Smith, (University of Maine)**

## 1. Introduction to Curricula in Sustainable Agriculture

A spectrum of involvement:

### PRINCIPLES & EXAMPLES

Specific examples can be brought into classes as part of the conventional topics included in a course; eg. crop improvement course: in breeding crops for sustainable systems, an important consideration is the genotype by environment interaction; for example, are the optimum rice varieties for intensive cultivation under irrigation the same ones that will do well under intermittent flooding and no fertilizer?

### MODULES IN COURSES

One topic or module can be introduced into a conventional course; eg. introductory agronomy course: an agroecology module was introduced into the lab part of the course for the last three weeks -- it emphasized the connectedness of systems and the potential non-sustainability of current Nebraska systems.

### COURSES IN SUSTAINABLE AGRICULTURE

A course can be introduced as part of the curriculum, and even broadcast to other locations and states; eg. Sustainable Agriculture, Agronomy 493 from Iowa State University was broadcast twice each week to 17 sites in 1991 (Dr. Ricardo Salvador); a number of such courses in sustainable agriculture and agroecology are included in the packet

### SERIES OF COURSES

A series of courses within a department or across departments can be included in the conventional curriculum; eg. proposal from UNL for Introductory Course, Biology of Agroecosystems Course, Crop Components Course, Seminar Course, and Capstone senior level Course.

### COMPLETE CURRICULA/DEGREES

University of Maine and Slippery Rock University (Pennsylvania) offer degrees; the Maine program has both B.S. and M.S. in Sustainable Agriculture, and a detailed description of the program and faculty is included.

# SUSTAINABLE AGRICULTURE

Agronomy 493/593

Ricardo Salvador  
Professor in Charge

## Course Outline

*"A sustainable agriculture is one that, over the long term, enhances environmental quality and the resource base on which agriculture depends; provides for basic human food and fiber needs, is economically viable, and enhances the quality of life for farmers and society as a whole."*  
-American Society of Agronomy, January 1989

November 8, 1989

**The Notion of a Sustainable Agriculture** - Agricultural innovations have allowed the production of large quantities of food and fiber of high quality and with high labor efficiency. However, in some cases this has been accomplished by practices that erode soils, deplete water tables, contaminate foodstuffs and the environment, and require large energy inputs. Sustainable agriculture embodies old and new ideas that address some of these problems while providing for a dependable food supply.



**November 15, 1989**

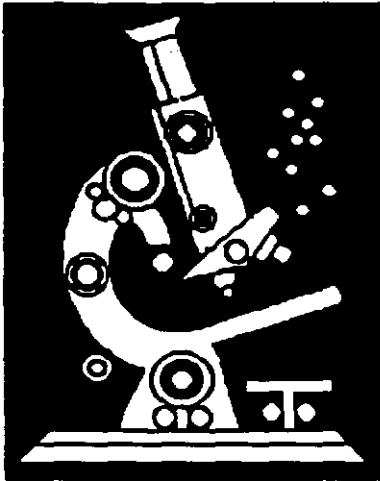
**Appropriate Tillage Systems** - Over 40% of energy inputs for agricultural production worldwide are for tractor power. Tractors greatly enhance labor productivity, but only in certain instances does mechanization enhance land productivity. In fact, mechanization of agriculture on erodible land might temporarily contribute to increased food output, but in the long range will decrease the land base available for food production. Since fossil energy shortfalls are projected for the future, a highly energy-dependent strategy of farm mechanization as we know it today may not be sustainable. What are the alternatives?

**November 22, 1989**

**Resource Conservation** - Irrigation has allowed expansion of the agricultural land base and has created a more dependable food supply. However, in numerous cases fossil water is mined for irrigation or aquifers are drained at greater than recharge rates. In addition, much agricultural land has been taken out of production because of salinization of poorly drained irrigated land. There are also serious non-agricultural sources of competition for groundwater reserves (industry, urbanization). How can the efficiency of water use for agriculture be improved? One of the consequences of machine operations on agricultural land is the heightened erosion of soil at rates far greater than the natural rate of soil formation. This leads to loss of productive land and to contamination of waterways. How can this primordial agricultural resource be better managed?

**November 29, 1989**

**Fertilizer Use and Groundwater Quality** - Chemical fertilizers increase productivity of the land and are responsible for a major portion of the boom in world agricultural output since 1950. But it is expensive to manufacture fertilizers, a fact that is mirrored in the trend for fertilizer sales to parallel grain prices. In developing countries, chemical fertilizers contribute to make agriculture energy-dependent and less labor-dependent. There is evidence of groundwater contamination with fertilizer salts and of eutrophication of lakes and streams. This is damaging to the environment and to organisms. How can fertilizer use strategies be improved?

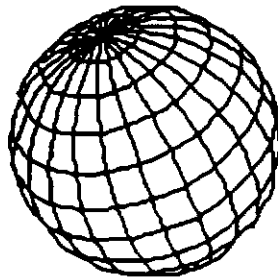


**December 6, 1989**

**The Issue of Food Security** - Supply of food for the future is threatened by various sources. For several decades the amount of land devoted to agriculture has decreased, while the demand for food has increased in accordance with growing population. This has put pressure on efforts to elevate land productivity. In turn, this has led to economic and ecologic problems which only now are being understood. Some such practices have ruined agricultural land due to salinization or erosion, and have drastically lowered water tables, limiting the viability of such areas for future agriculture. In addition, it is feared that certain industrial processes that are now affecting the earth's chemistry may lead to global warming and a resulting decrease of land that can be farmed with natural rainfall. This would increase the need for irrigation schemes, which are difficult to sustain ecologically, and expensive to sustain economically. Globally, output from farm land is showing signs of slowing in third world countries, and has actually reverted to sixties' levels on the African continent. This trend is driven by the flow of people fleeing rural poverty and relocating to urban centers. Because this pressures governments to spend more on cities by reallocating resources previously directed to rural areas, this weakens long-term food security since this can only be ensured by stable and productive farm economies.

**December 13, 1989**

**Policy Concerns** - Individual farm economies must function within the national economy, wherein private agriculture is manipulated by policy mechanisms such as commodity subsidies and trade restrictions. Economic power in the agricultural sector is increasingly concentrated in industrial enterprises. As a result, important economic decisions at the farm level are dictated by factors external to the farm. Are these the characteristics of a sustainable agricultural economy?



**December 20, 1989**

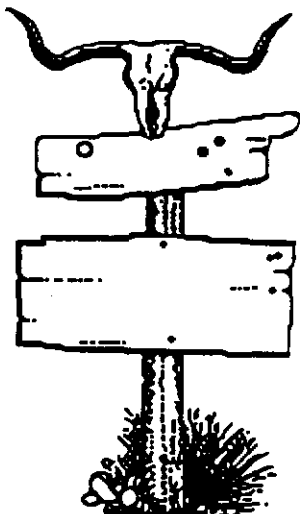
**Farming Systems** - Fossil fuel consumption of world agriculture increased sevenfold over the past 40 years. Cheap energy prices enabled a boom of agricultural productivity as energy was substituted for land in order to boost output. Whereas farms at one time were self-sufficient in terms of energy requirements (draft animals, livestock manures), the modern farm depends on external sources of energy to manufacture and power tractors, manufacture and apply fertilizers and pesticides, and to pump water for irrigation. Coal, natural gas, and oil provide most of this external energy. As fossil fuels are depleted, and as food requirements demand more energy-intensive inputs to produce greater yields, agriculture will become more vulnerable to this dependance on external energy sources, and increasingly unsustainable. Are there any alternatives to enable farmers to produce at world-demand levels without requiring more energy as input than is produced on the farm itself?

January 10, 1990

**Sustainable Agricultural Economies** - Distinct economic decisions can be made depending on the number of generations the decision is intended to benefit. Traditional farm planning tends to be for the short-range, leading to decisions that may neglect the impact of certain practices on the viability of farmland and farming for future generations. The concept of 'production efficiency' (maximizing output/minimizing input) needs to be rethought keeping this in mind.

January 17, 1990

**Agroecology** - A major premise is that an agricultural system is made sustainable by incorporating the recycling of resources into management strategies. This minimizes reliance on external resources that often increase energy-dependence and indebtedness. Major internal nutrient cycles that can be closed are: nitrogen and other nutrients in organic matter and livestock waste, rainwater, the energy in a feed and livestock cycle, and the labor provided by a family living on the farm.



**January 24, 1990**

**Public Health Concerns** - Great effort and capital are expended in designing, developing, and regulating the use of chemicals applied to crops and foodstuffs. In spite of this, various government agencies and public interest groups disagree on whether public health is sufficiently guarded. Tolerances for pesticides in food products are specified at a particular level, whereas the amount and proportions of the various food groups ingested, and the ability to metabolize substances, differs among age groups. Aside from minimizing the need of agriculture to depend on synthetic chemicals, can the safety of food be improved or better monitored?

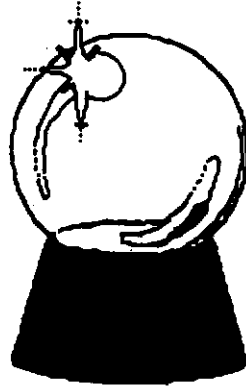
**January 31, 1990**

**Role of Pesticides and Biotechnology** - Pesticide application has helped control crop pests, increase the quality of foodstuffs, and make producers more labor-efficient. Nonetheless, many of these synthetic substances have altered the earth's chemical cycles, introducing harmful byproducts into food and affecting the reproductive success of various animal species. This has occurred even though farm chemicals are extensively scrutinized before commercialization. The risks associated with use of manufactured chemicals are associated more with what is unknown about their effects on health than on what is known. Pesticide strategies have been developed that seek to minimize pesticide reliance while maintaining adequate control of pests. It is possible that new biotechnologies may enable production of more robust agricultural species; however, this will require time and large capital outlays.



**February 7, 1990**

**Progressing Toward a Sustainable Agriculture -** Converting from traditional farming methods to more sustainable practices entails shifts in many factors internal and external to the farm. Farm policy, industrial practice, resource and land-use thinking must change. How can the individual farmer begin to make this change on his/her own land?



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**SUSTAINABLE AGRICULTURE**Agronomy 493  
(2 Credits)

AG\*SAT - Spring 1991

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- ① Critique proposal
- ② Distribute publ. lists
- ③ Show add. videos
- ④ FACTS Schedule
- ⑤ SUS AGR SEMINARS

"...small farmers are experimental and adaptive--they cannot afford not to be. They need it is now realized, not messages but methods, not precepts but principles, not a package of practices but a basket of choice, not a fixed menu--table d'hote, but a choice--a la carte, not instruction on what to adopt, but ideas about what to try, with support for their own trials and experimentation."

-Robert Chambers, University of Sussex, 1988

**Session Topic**

22 Jan "Conventional" and "Sustainable" Agriculture: What is the difference?

24 Jan Historical survey of agricultural origins.

29 Jan The concept of the "Agroecosystem." Problem-solving via the "bigger hammer" approach.  
 "Soft" systems methodologies.

**TRANSITION FROM ANIMAL-TRACTION TO MECHANIZED AGRICULTURE**

31 Jan Subsistence agriculture and production agriculture. A difference of scale or world-view?  
 Environmental carrying capacity.

5 Feb Objectives of tillage. Cropping systems ensuing from animal-traction. Impetus for mechanization.

7 Feb Environmental impact of tillage.

12 Feb Consequences of livestock in the agroecosystem: Energy cycles in the crop/livestock system, manure management.

14 Feb Soil conservation. Reduced tillage. Cover crops. Rotations. Terraces. Contours.  
 Drainage practices. The primacy of the ecosystem.

**CHEMICAL AGRICULTURE**

19 Feb Demographics, Green Revolution, the "greater yields" syndrome, and the stimulus for production agriculture.

Session      Topic

21 Feb      Reductionist science and the scientific basis of fertilizer application: crop plant mineral nutrition.

26 Feb      Fertility rites: Tull, Liebig, Blackman. Fertilizer response curves. The black art of fertilizer recommendations.

28 Feb      Fate of applied fertilizing substances. Nitrogen interconversions.

5 Mar      Nitrate and phosphorus pollution of groundwater. The point-source controversy. Eutrophication of natural waterways.

7 Mar      Case history: Herman Warsaw and 370 bu. of corn/acre. Agriculture gone amuck or hope for the future?

19 Mar      Weed management strategies. Evolving philosophies: management versus elimination. Advantages and disadvantages of mechanical/cultural control of weeds.

21 Mar      Crop physiological ecology: the place of weeds in a cropping system.

26 Mar      The scientific basis of chemical weed control. Plant metabolism. The principle of chemical selectivity.

28 Mar      World War II and chemical opportunism. The Vietnam War, 2,4,5-T, dioxin, *Silent Spring* and the home front. How the "successful" herbicide has changed: 2,4-D, atrazine, glyphosate.

2 Apr      Herbicides and the environment. Effects on non-target people, plants, and places.

4 Apr      The lesser of two evils: The fungus or the fungicide? Case study: Seedling diseases and Captan.

9 Apr      Insecticides, continuous cropping, insecticides, continuous cropping, insecticides, continuous cropping,....

**TOWARD A MORE SUSTAINABLE AGRICULTURE**

11 Apr      Early technological revisionism: Conservation Farming, Reduced Tillage, Integrated Pest Management.

16 Apr      Biotechnology: A sustainable technology or a bigger hammer?

18 Apr      The deception of alternative crops: using "new" species in old ways.

23 Apr      Lessons from the third world: 1000 years of agriculture in China, Peru, Mexico. Genetic diversity, intercropping, crop rotation, terracing.

**PHILOSOPHY AND AGRICULTURE**

25 Apr      Water management. Irrigation and (miracle / folly) in the desert.

30 Apr      Rediscovering the wheel: the concept of Farming Systems Research.

Session      Topic

- 2 May      The ecosystem: ally or object of conquest? Ecofeminism.  
5 May      Philosophy and agriculture.  
7 May      Philosophy and agriculture.  
9 May      Economics, human equality, global sustainability.

**EVALUATION:** Weekly study questions will be provided. Students will be evaluated by site coordinators at each participating institution.

**INTERACTION:** An electronic bulletin board will be available for students to post and discuss ideas related to the course. To utilize this bulletin board, students must have an account on a computer with access to INTERNET.

**TEXTBOOK:** Carroll, C. R., J. H. Vandermeer, and P. M. Rosset. 1990. *Agroecology*. McGraw Hill (\$90). Because of cost, the textbook is not required.

**SUPPLEMENTARY REFERENCES:**

- \* Reserve
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- \* Altieri, M. A. 1987. *Agroecology. The Scientific Basis of Alternative Agriculture*. Westview Press.
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- \* Berry, W. 1977. *The Unsettling of America: Culture and Agriculture*. Sierra Club Books.
- \* Brown, L. R. 1987. *State of the World. A Report on Progress Toward a Sustainable Society*. Worldwatch Institute.
- \* Chambers, R., A. Pacey and L. A. Thrupp. 1989. *Farmer First : Farmer Innovation and Agricultural Research*. Bootstrap Press.

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COURSE OUTLINE  
 Principles and Practices of Sustainable Agriculture  
 PSE 105  
 Spring 1991  
 Instructor: Dr. Matt Liebman

<u>Date</u>	<u>Topic and Required Reading (# on reading list)</u>
Jan 15	Introduction
Jan 17	Sustainable agriculture: definitions and approaches (1, 2,3)
Jan 22	Agroecosystems: concepts and examples (4,5)
Jan 24	Crop production as a means of capturing and converting solar energy
Jan 29	Sustainable livestock production (6)
Jan 31	Social impacts of agriculture (7,8)
Feb 5	Water resources for agriculture and impacts of irrigation (9)
Feb 7	Energy costs of agriculture (10)
Feb 12	Sources of nutrients for crop production I. (11,12)
Feb 14	Sources of nutrients for crop production II.
Feb 19	EXAM
Feb 21	Soil erosion and crop productivity (13)
Feb 26	Soil conservation practices
Feb 28	Crop rotations I. (14)
Mar 4 - 18	SPRING BREAK
Mar 19	Crop rotations II.
Mar 21	Polyculture cropping systems I. (15)
Mar 26	Polyculture cropping systems II.
Mar 28	Genetic diversity of crops and livestock I. (16)
Apr 2	Genetic diversity of crops and livestock II.
Apr 4	Pest ecology and management I. (17,18,19,20,21)
Apr 9	Pest ecology and management II.
Apr 11	Pest ecology and management III.
Apr 16	Pest ecology and management IV.
Apr 18	EXAM
Apr 23	Organic farming (22)
Apr 25	Transitions from conventional to more sustainable farming systems
Apr 30	Hunger and the Green Revolution in developing nations (23,24)
May 2	Sustainable agriculture in developing nations (25,26,27)



Principles and Practices of Sustainable Agriculture  
PSE105  
Spring 1991  
Instructor: Dr. Matt Liebman

1. There are no prerequisites for this course but students are expected to do the reading thoroughly. A large amount of information and many data sets will be presented. If you find yourself getting behind, talk to me as soon as possible.
2. Lectures and discussions will be based on 27 readings culled from a variety of sources. Bound volumes of the text materials will be at the reserve desk in Fogler Library. Be sure to do the reading as the course proceeds. When working with the material, allow enough time to be sure you understand it. Supplementary references will be provided during lectures so that you can look in more detail at subjects that interest you.
3. There will be two in-class mid-term exams (100 points each) and a take-home final exam (200 points). There will also be two homework assignments (50 points each). **Homework assignments and the final exam must be typed or they will not be accepted.** Students are expected to attend class and to be ready to be called upon.
4. Grades:

A+: 484-500	A: 467-483	A-: 450-466
B+: 434-449	B: 417-433	B-: 400-416
C+: 384-399	C: 367-383	C-: 350-366
D+: 334-349	D: 317-333	D-: 300-316
E: <300 points		

PSE 105  
PRINCIPLES AND PRACTICES OF SUSTAINABLE AGRICULTURE

REQUIRED READINGS

1. Douglass, G.K. 1985.  
When is agriculture sustainable? Pp. 10-21 in: Edens, T.C., Fridgen, C., and Butterfield, S.L. Sustainable Agriculture and Integrated Farming Systems. Michigan State University Press, East Lansing, Michigan.
2. Jarrell, W.M. 1987.  
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Sustainable agriculture. Scientific American 262(6):112-120.
4. Cox, G.W. and Atkins, M.D. 1979.  
The ecosystem concept. Pp. 37-58, Agricultural Ecology: An Analysis of World Food Production Systems. W.H. Freeman & Co., New York.
5. Altieri, M.A. 1987.  
Traditional agriculture. Pp. 69-91, Agroecology - The Scientific Basis of Alternative Agriculture. Westview Press, Boulder, Colorado.
6. Murphy, B. 1990.  
Pasture management. Pp. 231-262, C. Francis, L. King and C. Flora (Eds.), Sustainable Agriculture in Temperate Zones. John Wiley and Sons, New York.
7. Strange, M. 1988.  
Industrializing American agriculture. Pp. 31-42, Family Farming: A New Economic Vision. Univ. of Nebraska, Lincoln.
8. Vogeler, I. 1981.  
The decline of agriculturally dependent small towns. Pp.251-264, The Myth of the Family Farm: Agribusiness Dominance of U.S. Agriculture. Westview Press, Boulder, Colorado.
9. Cox, G.W. and Atkins, M.D. 1979.  
Impacts of irrigation and fertilization. Pp.297-327, Agricultural Ecology: An Analysis of World Food Production Systems. W.H. Freeman & Co., New York.
10. Cox, G.W. and Atkins, M.D. 1979.  
Energy costs of agriculture. Pp.597-629, Agricultural Ecology: An Analysis of World Food Production Systems. W.H. Freeman & Co., New York.
11. Cox, G.W. and Atkins, M.D. 1979.  
Soil and plant microbiology. Pp.328-355, Agricultural Ecology: An Analysis of World Food Production Systems. W.H. Freeman & Co., New York.
12. King, L.D. 1990.  
Sustainable soil fertility practices. Pp. 144-177, C. Francis, L. King and C. Flora (Eds.), Sustainable Agriculture in Temperate Zones. John Wiley and Sons, New York.
13. Pimentel, D., et al. 1987.  
World agriculture and soil erosion. Bioscience 37(4):277-283.
14. Power, J.F. 1990.  
Legumes and crop rotations. Pp. 178-204, C. Francis, L. King and C. Flora (Eds.), Sustainable Agriculture in Temperate Zones. John Wiley and Sons, New York.

15. Liebman, M. 1987.  
Polyculture cropping systems. Pp.115-125, Altieri, M.A.(ed.). Agroecology: The Scientific Basis of Alternative Agriculture. Westview Press, Boulder, Colorado.
16. Harlan, J.R. 1976.  
The plants and animals that nourish man. Scientific American 235(3):88-97.
17. Prokopy, R.J. 1986.  
Toward a World of Less Pesticide, Research Bulletin #710, Massachusetts Agricultural Experiment Station. University of Massachusetts at Amherst.
18. Bottrell, D.R. 1979.  
Integrated Pest Management: definitions, features and scope. Pp. 19-26, Integrated Pest Management. Council on Environmental Quality, Washington, D.C.
19. Fry, W.E. and Thurston, H.D. 1980.  
The relationship of plant pathology to integrated pest management. BioScience 30(10):665-669.
20. Cook, R.J. 1986.  
Interrelationships of plant health and the sustainability of agriculture with special reference to plant diseases. American Journal of Alternative Agriculture 1(2):19-24.
21. Liebman, M. and Janke, R. 1990.  
Sustainable weed management practices. Pp.111-143, C. Francis, L. King, C. Flora (Eds.), Sustainable Agriculture in Temperate Zones, John Wiley and Sons, New York.
22. Sinclair, W. 1985.  
"Organic farmers still harvesting profits." The Washington Post, Sept. 1, 1985.
23. Wade, N. 1974.  
Green Revolution (I): A just technology, often unjust in use. Science 186:1093-1096.
24. Wade, N. 1974.  
Green Revolution (II): Problems of adapting a western technology. Science 186:1186-1192.
25. Tangle, L. 1987.  
Beyond the green revolution. Bioscience 37(3):176-180.
26. Altieri, M.A. 1986.  
The grass roots approach to rural development in Latin America. Alternatives 13(4):22-27.
27. Winterbottom, R. and P.T. Hazlewood. 1987.  
Agroforestry and sustainable development: making the connection. Ambio 16(2/3):100-110.

Course Outline  
**PRINCIPLES AND PRACTICES OF SUSTAINABLE AGRICULTURE**  
PSE 105  
Spring 1992  
Instructor: Dr. Matt Liebman

1. There are no prerequisites for this course but students are expected to do the reading thoroughly. A large amount of information and many data sets will be presented. If you find yourself getting behind, talk to me as soon as possible.
2. Lectures and discussions will be based on 27 readings culled from a variety of sources. Bound volumes of the text materials will be at the reserve desk in Fogler Library. Be sure to do the reading as the course proceeds. When working with the material, allow enough time to be sure you understand it.
3. There will be two in-class mid-term exams worth 100 points each and a final exam worth 200 points. There will also be two homework assignments worth 50 points each. **Homework assignments and the final exam must be typed or they will not be accepted.** Students are expected to attend class and to be ready to be called upon.
4. Grades:

A+: 484-500	A: 467-483	A-: 450-466
B+: 434-449	B: 417-433	B-: 400-416
C+: 384-399	C: 367-383	C-: 350-366
D+: 334-349	D: 317-333	D-: 300-316
E: <300 points		

## SCHEDULE

<u>Date</u>	<u>Topic and Required Reading</u>
Tu Jan 12	Introduction
Th Jan 14	<p>Sustainable agriculture: definitions and approaches.</p> <p>Video: "The Price of Bounty"</p> <ul style="list-style-type: none"> <li>• Douglass, G.K. 1985. When is agriculture sustainable? Pp. 10-21 in: T. C. Edens., C. Fridgen, and S. L. Butterfield. <u>Sustainable Agriculture and Integrated Farming Systems</u>. Michigan State University Press, East Lansing, Michigan.</li> <li>• Jarrell, W. M. 1987. Sustainable agriculture. <u>Drylander</u> 1(2): 1.</li> <li>• Reganold, J. P., R. I. Papendick, and J. F. Parr. 1990. Sustainable agriculture. <u>Scientific American</u> 262(6): 112-120.</li> </ul>
Tu Jan 19	<p>Agroecosystems: concepts and examples.</p> <ul style="list-style-type: none"> <li>• Cox, G. W. and M. D. Atkins. 1979. The ecosystem concept. Pp. 37-58 in: <u>Agricultural Ecology: An Analysis of World Food Production Systems</u>. W. H. Freeman &amp; Co., NY.</li> <li>• Altieri, M. A. 1987. Traditional agriculture. Pp. 69-91 in: M. A. Altieri (ed.), <u>Agroecology-The Scientific Basis of Alternative Agriculture</u>. Westview Press, Boulder, CO.</li> </ul>
Th Jan 21	Agroecosystems. Livestock production systems.
Tu Jan 26	<p>Sustainable livestock production. Rotational intensive grazing systems.</p> <p>Video: "Rotational grazing"</p> <ul style="list-style-type: none"> <li>• Murphy, B. 1990. Pasture management. Pp. 231-262 in: C. Francis, L. King, and C. Flora (eds.), <u>Sustainable Agriculture in Temperate Zones</u>. John Wiley, NY.</li> </ul>

Th Jan 28

Social impacts of agriculture.

Video: "Potatoes"

- Strange, M. 1988. Industrializing American agriculture. Pp. 31-42 in: Family Farming: A New Economic Vision. Univ. of Nebraska Press, Lincoln, NE.
- Vogeler, I. 1981. The decline of agriculturally dependent small towns. Pp. 251-264 in: The Myth of the Family Farm: Agribusiness Dominance of U.S. Agriculture. Westview Press, Boulder, CO.

Tu Feb 2

Energy costs of agriculture.

- Cox, G. W. and M. D. Atkins. 1979. Energy costs of agriculture. Pp. 597-629 in: Agricultural Ecology: An Analysis of World Food Production Systems. W. H. Freeman & Co., NY.

Th Feb 4

Water resources for agriculture and impacts of irrigation.

Video: "The Desert Doesn't Bloom Here Anymore"

- Cox, G. W. and M. D. Atkins. 1979. Impacts of irrigation and fertilization. Pp. 297-327 in: Agricultural Ecology: An Analysis of World Food Production Systems. W. H. Freeman & Co., NY.

Tu Feb 9

Sources of nutrients for crop production.

- Cox, G. W. and M. D. Atkins. 1979. Soil and plant microbiology. Pp. 328-355 in: Agricultural Ecology: An Analysis of World Food Production Systems. W. H. Freeman & Co., NY.

Th Feb 11

Sources of nutrients for crop production.

- King, L. 1990. Sustainable soil fertility practices. Pp. 144-177 in: C. Francis, L. King, and C. Flora (eds.), Sustainable Agriculture in Temperate Zones. John Wiley, NY.

Tu Feb 16

EXAM

Th Feb 18	<p>Soil erosion and crop productivity.</p> <p>Video: "Will the World Starve?"</p> <p>Pimentel, D. et al. 1987. World agriculture and soil erosion. <u>BioScience</u> 37: 277-283.</p>
Tu Feb 23	<p>Soil conservation practices.</p>
Th Feb 25	<p>Crop rotation.</p> <p>• Power, J. F. 1990. Legumes and crop rotations. Pp. 178-204 in: C. Francis, L. King, and C. Flora (eds.), <u>Sustainable Agriculture in Temperate Zones</u>. John Wiley, NY.</p>
Tu Mar 2	<p>Crop rotation.</p>
Th Mar 4	<p>Genetic diversity of crops and livestock.</p> <p>Video: "Seeds of Tomorrow"</p> <p>• Harlan, J. R. 1976. The plants and animals that nourish man. <u>Scientific American</u> 235(3): 88-97.</p>
Spring Recess	
Tu Mar 23	<p>Polyculture cropping systems.</p> <p>• Liebman, M. 1987. Polyculture cropping systems. Pp. 115-125 in: M. A. Altieri (ed.), <u>Agroecology—The Scientific Basis of Alternative Agriculture</u>. Westview Press, Boulder, CO.</p>
Th Mar 25	<p>Polyculture cropping systems.</p>
Tu Mar 30	<p>Pest ecology and management.</p> <p>• Prokopy, R. J. 1986. <u>Toward a World of Less Pesticide</u>. Research Bulletin #710, Mass. Ag. Expt. Stn., Univ. of MA., Amherst.</p>

- Th Apr 1                      Pest ecology and management.
- Video: "IPM for Apples"
- Bottrell, D. R. 1979. Integrated Pest Management: definitions, features, and scope. Pp. 19-26, Integrated Pest Management. Council on Environmental Quality, Washington, D. C.
- Tu Apr 6                      Pest ecology and management.
- Fry, W. E. and H. D. Thurston. 1980. The relationship of plant pathology to integrated pest management. BioScience 30: 665-669.
  - Cook, R. J. 1986. Interrelationships of plant health and the sustainability of agriculture with special reference to plant diseases. American Journal of Sustainable Agriculture 1: 19-24.
- Th Apr 8                      Pest ecology and management.
- Liebman, M. and R. Janke. 1990. Sustainable weed management practices. Pp. 111-143 in: C. Francis, L. King, and C. Flora (eds.), Sustainable Agriculture in Temperate Zones. John Wiley, NY.
- Tu Apr 13                      EXAM
- Th Apr 15                      Organic farming.
- Sinclair, W. 1985. Organic farmers still harvesting profits. The Washington Post, Sept. 1, 1985.
- Tu Apr 20                      Transitions to sustainable farming systems.
- Video: "Field Crops"
- Th Apr 22                      Hunger and the Green Revolution in developing nations.
- Wade, N. 1974. Green Revolution (1): A just technology, often unjust in use. Science 186: 1093-1096.
  - Wade, N. 1974. Green Revolution (2): Problems of adapting a western technology. Science 186: 1186-1192.



Tu Apr 27

Sustainable agriculture in developing nations.

- Tangle, L. 1987. Beyond the Green Revolution. BioScience 37: 176-180.

- Altieri, M. A. 1986. The grass roots approach to rural development in Latin America. Alternatives 13(4): 22-27.

- Winterbottom, R. and P. T. Hazlewood. 1987. Agroforestry and sustainable development: making the connection. Ambio 16(2/3): 100-110.

Th Apr 29

Closing remarks, review, and discussion.

COURSE OF AGRICULTURAL ECOSYSTEMS

1. Name of the course: Agricultural Ecosystems - (F&ES 507a)
2. Semester: Fall, 1991.
3. To be taught by: Ricardo Russo
4. Credits: 2 (two).
5. Need of the course: Recent public concern over the dramatic depletion and pollution of invaluable soil and water resources resulting from intensive application of mineral fertilizer and pesticides has raised serious reconsideration of knowing more about agricultural practices in general.

The concern is that agriculture as practiced today, may not be environmentally, socially, or economically sustainable.

In many third world countries crop agriculture and forestry must coexist and be integrated and students of natural resources need to consider ways to optimize both forest and food production.

In order to protect the natural resources from further degradation caused by agriculture, it is necessary that the professionals dealing with natural resources management better understand the basic concepts of agricultural ecosystems (AE), their structure and function, and the ways to manage them in an appropriate manner trying to minimize the negative environmental impacts.

6. Fundamentals: In this course it is intended to introduce the students at YSF&ES into an agricultural perspective with the purpose of contributing to the formation of a professional able to participate in the socio-productive processes with an environment-protecting point of view.

The course will consider how a natural system works in terms of energy flow, nutrient cycling hydrology, and how a terrestrial system is connected to a hydrologic system (streams, lakes, groundwater). Understanding a theoretical natural system will allow to show the students how agriculture changes the natural system, and how costs arise from poor agricultural practices. A major part of the course will be that agriculture should be as close to nature as reasonable productivity of crops permits.

7. Objectives:

7.1 To better understand AE, to analyze them and to provide management concepts within an agroecological

'framework. It is especially relevant to those M.S. students whose background has not been related to agriculture.

7.2 To identify the main ecological problems related to the use of natural resources and primary production.

7.3 To apply basic ecological concepts to the agricultural and forestry productive processes.

7.4 To use ecological methodologies to study agricultural ecosystems.

#### 8. Teaching goals

After the course the students will be able :

8.1 To recognize and analyze any AE with their components and their relationships.

8.2 To evaluate and to diagnose deficiencies from an agroecological point of view.

8.3 To intervene, to manage, and to improve AE.

9. Methodology: Basically, the course format will have twenty four hours of lectures, in which theoretical material will be presented. Application of this material it is intended to be done in field practices. Readings will be assigned every week. In addition each student must prepare a term paper on a topic related to the course. Course evaluation will be done by two exams (50%), a term paper (30 %) and field practices (20%).

10. Syllabus: The first half of the course will build upon understanding of system ecology and environmental factors as they affect agriculture. The second half of the course will function on understanding the role of vegetation and soils as natural resources, the crops as ecological systems, and the manipulation of the ecosystems by and for humans.

**First week:** Course introduction and organization. Problems related to the environmental changes in different scales and the conflicts between natural resources and the way of using them. The Hubbard Brook model as a natural system. Agriculture in a perspective view, and how it changes the natural system.

**Second week:** Components of the agricultural ecosystem; its structure and function, and the relationships among its

components, and with the environmental factor. Annuals and perennials

**Third week:** Properties and dynamics of the agroecosystem populations and the characteristics and processes that make possible its evolution and its adaptation. Organization of components.

**Fourth week:** The agroecosystem community, its structure and its ecological behavior. Hierarchical relationships among agroecosystems, plant systems, and crop systems.

**Fifth week:** The crops as agroecological systems and the interactions between the crop with the atmosphere and the soil: the microclimate, the rhizosphere and the processes related to the soil and its biota.

**Sixth week:** Midterm exam.

**Seventh week:** Need of knowing the vegetation to make a rational use of the resource. The different approaches in the study of vegetation. Structural and floristic. Introduction to the Holdridge Life Zone System.

**Eighth week:** The main land use production systems: agricultural, husbandry, and forestry. Boundary systems. The concepts of plant production (food, fiber, timber, medicines, recreation), horticulture and related areas, agronomy, biotechnology applied to agriculture. Conservation.

**Ninth week:** Modern agriculture in both developed and developing countries. The use and misuse of chemical inputs and their environmental impacts. Fertilizers, pesticides, herbicides.

**Tenth week:** The use of models in the management of agricultural systems. Modelling as a way of understanding agroecosystem components, inputs, outputs, boundaries, and internal interactions.

**Eleventh week:** The concept of sustainable agriculture and sustainable forestry in terms of practicality. How costs arise from poor agricultural practices. The concept of alternative agriculture as close to nature as reasonable productivity of crops permits.

**Twelfth week:** General discussion and analysis of the course situation.

Final Exam: in exam week

## 9. Bibliography:

- Altieri, M. 1987. Agroecology: the scientific basis of alternative agriculture. Westview Press, Boulder, Colorado. 227 p. (TEXTBOOK)
- Bormann, F.H. and G.E. Likens. 1981. Pattern and process in a forested ecosystem. Springer-Verlag, New York. 253 p.
- Etherington, J.R. 1982. Environment and plant ecology. 2 ed. J. Wiley, New York, 487 p.
- Francis, C.A. ed. 1986. Multiple cropping systems. Macmillan Publishing Company, New York. 383 p.
- Gliessmann, S.R. (ed.) 1990. Agroecology: researching the ecological basis for sustainable agriculture. Springer-Verlag, New York.
- Gold, H.J. 1977. Mathematical modeling of biological systems: an introductory guidebook. J. Wiley-Inter-Science, New York. 357 p.
- Harper, J.L. 1977. Population biology of plants. Academic Press, London. 892 p.
- Hart, R.D. 1980. A natural ecosystem analog approach to the design of a successional crop system for tropical forest environments. Biotropica 12(Suppl.):73-82.
- Hart, R.D. 1986. Ecological framework for multiple cropping research. In Multiple cropping systems. C.A. Francis (ed.), Macmillan Publishing Company, New York. pp. 40-56
- Lowrance, R., B.R. Stinner and G.J. House. 1984. Agricultural ecosystems: unifying concepts. J. Wiley, New York, 257 p.
- Newman, E. 1982. The plant community as working mechanism. Blackwell, Oxford. 128 p.
- Poincelot, R.P. 1986. Toward a more sustainable agriculture. AVI Publishing Company, Inc. Westport, Connecticut. 241 p.
- Shanner, W.W., P.F. Philipp and W.R. Schmehl (eds.). 1982. Readings in farming systems, research and development. Westview Press, Boulder, Colorado. 175 p.
- Spedding, C.R.W., J.M. Walsingham, and A.M. Hoxey. 1981. Biological efficiency in agriculture. Academic Press, London. 383 p.
- Vandermeer, J. 1989. The ecology of intercropping. Cambridge University Press, Cambridge. 237 p.
- Whittaker, R.H. 1975. Communities and ecosystems. 2 ed. Macmillan, New York. 385 p.

BERKELEY

U. CALIFORNIA  
(BERKELEY)

AGRICULTURAL ECOLOGY  
CRS 102  
LECTURE TOPICS

January

- 24 Examining key issues. Videos: "Hunger for Profit" and "Fields of Fear." Reading assignments.
- 26 Discussion of papers "Feeding the Earth" and "The Evolution of Agroecological Thought."
- 31 The scope of agroecology

February

- 2 Agroecosystem dynamics
- 7 Agroecosystem dynamics
- 9 Land, energy and the resource base for agriculture
- 14 Land, energy and the resource base for agriculture
- 16 Environmental impacts of agricultural technology
- 21 Social impacts of agricultural expansion: U. S.
- 23 Social impacts of agricultural expansion: Third World
- 28 Agricultural development: nutritional consequences, public health links

March

- 2 Gender issues: women in agriculture
- 7 Ecological and socio-economic impacts of biotechnology
- 9 The crop-seed germplasm controversy. Video: "Seeds of Tomorrow"
- 14 Traditional agriculture: Video: "The Chinampas"
- 16 Traditional agriculture
- 21 Recess
- 23 Recess
- 28 Traditional knowledge systems of resource use. Mid-term papers due.
- 30 Multiple cropping systems

April

- 4 Multiple cropping systems
- 6 Agroforestry systems. Video: "Keepers of the Forest"

- April
- 11 Agroforestry systems
  - 13 Organic farming in the United States. Video: "Looking for Organic America"
  - 15-16 Field Trip
  - 18 Rotations, cover crops
  - 20 Minimum tillage systems
  - 25 Methodologies to study agroecosystems. Field trip reports due.
  - 27 Methodologies to study agroecosystems
- May
- 2 Agroecology and rural development. Video: "Mexico's integrated farms"
  - 4 Agroecology and rural development
  - 9 Sustainable agriculture
  - 11 Sustainable agriculture
  - 18 Final Exam 8:00-11:00 a.m.

U. CALIFORNIA  
(SANTA CRUZ)

Environmental Studies 130  
Agroecology  
Stephen Gliessman

Fall 1989  
UCSC  
T.A. Francisco Espinosa

## SYLLABUS

### INTRODUCTION

Agroecology is the application of ecological concepts and principles to the design and management of sustainable agroecosystems. The course will develop a theoretical and conceptual framework for the study and analysis of agroecosystems. The first half of the course will build upon the understanding of autecology and factors of the environment as they affect agriculture. The second half of the course will function more at the ecosystem level, exploring the integration and interrelationships of interactions in agroecosystems. Case studies will be used to demonstrate how ecology can be applied to agriculture. The concept of agricultural sustainability is presented as a means of unifying thought about agroecology.

**Course Format:** Theoretical material will be presented in three weekly lectures, with direct application of this material to field or laboratory situations in a weekly laboratory section.

### Schedule:

<u>Week of:</u>	<u>Lecture Area</u>
Sep. 29	Course introduction and organization
Oct. 2	Ecology and agriculture within the concept of the agroecosystem. The autecological focus. Environmental factors: soil
Oct. 9	Environmental factors: water in the soil and in the atmosphere, and temperature.
Oct. 16	Environmental factors: light, wind, and fire.
Oct. 23	Environmental factors: biotic. Interference and the environmental complex.
Oct. 30	<u>MIDTERM EXAM</u>  Adaptation, evolution, domestication, and managing genetic resources
Nov. 6	Dispersal and establishment, and the ecological niche; island biogeography theory; applications in agriculture.
Nov. 13	Mutualisms and coexistence; interference and biological control; diversity and stability in relation to system productivity.
Nov. 20	Disturbance and succession; structure and function; productivity, production, and yield.



- Nov. 27      Agroecosystem management and alternatives for the future.
- Dec. 4        Review and conclusions.

Reader: A reader with weekly assignments is required. Readings are designed to present basic background information in ecology as well as case studies where ecology is applied to agriculture. It is very strongly recommended and emphasized that it is important to read the assigned readings early in the week that they are required.

Course Evaluation: Final evaluation is based on the student's performance on the midterm and final examination, periodic written assignments or papers, laboratory performance and participation, and preparation of laboratory reports. Lecture and laboratory have approximately equal weight in the final evaluation.

**SCHOOL OF BUSINESS AND APPLIED SCIENCES  
AGRICULTURE AND INDUSTRIAL TECHNOLOGY DEPARTMENT  
CHADRON STATE COLLEGE**

**COURSE OUTLINE  
AGRICULTURAL ECOLOGY AND SUSTAINABILITY  
AGRI 344  
4 HOURS**

**DR. JAMES T. O'ROURKE**

**1993**

Date: January 11, 1993  
Instructor: Dr. James T. O'Rourke  
Office Number: Burkhiser 144  
Telephone Number: 432-6274

COURSE TITLE: Agricultural Ecology and Sustainability

COURSE NUMBER: AGRI 344

COURSE CREDIT: 4 Hours: 2:00-3:00 T; 2:00-5:00 R

COURSE DESCRIPTION:

Analyzes the relationship between crops, livestock and the bio-physical environment and the extent to which man has managed and modified the products and the environment to suit his own needs. Explores the alternatives, options and future of agricultural systems for the production of food, feed grains, fiber and other human needs in temperate climates. Prerequisite: AGRI 141.

TEXT:

Francis, Charles A., Cornelia Butler Flora and Larry D. King. 1990. Sustainable Agriculture in Temperate Zones. John Wiley and Sons. 487 pp.

ADDITIONAL READING ASSIGNMENTS:

On reserve in Reta King Library.

COURSE OBJECTIVES:

To acquaint students with the thinking among many agricultural and environmental leaders toward making agriculture more sustainable. This requires a delineation of its concepts, components and terminology as viewed by various interest groups. This will enable the student to communicate on the issues both within and outside of his/her familiar setting.

COURSE METHOD OF INSTRUCTION:

Lecture (both in person and by satellite) and group discussion

ATTENDANCE POLICY:

Attendance is necessary to enable participation in group discussions, which makes up a large percentage of the grading structure.

GRADING:

Class and field trip participation	200 points
Class presentation	100 points
Exams (2 @ 100 each) Essay, take-home exams	<u>200</u> points
Total	500 points

**DISCLAIMER:**

Information contained in this syllabus was, to the best knowledge of the instructor, considered correct and complete when distributed for use at the beginning of the semester. However, this syllabus should not be considered a contract between Chadron State College and any student. The instructor reserves the right, acting within the policies and procedures of CSC, to make changes in course content or instructional technique without notice or obligation.

**COURSE CONTENT:**

1. Conventional versus Sustainable Agriculture/Agroecology/Farming Systems Research
2. Sustainability as the underpinning in agricultural and natural resource sciences.
3. Anthropological views of agriculture.
4. Economics and sustainability.
5. International examples of sustainability
6. Pest Management
7. Private and Public Soil Testing Recommendations
8. Minimum tillage/Soil management
9. Irrigation Systems
10. Alternative crops/Plant breeding
11. Grazing practices
12. Nebraska Center for Sustainable Agriculture
13. Case Studies
14. Future of and converting to sustainable agriculture

## SPRING SEMESTER 1993

### Ag Calendar

<b>January</b>	11	12 Introduction ----- Short Duration Grazing - Chadron	13 HRM Meeting	14 Sustainability as underpinning in science	15
	18	19 Video - The New Farmer and the New Agriculture	20	21 Conventional vs. Sustainable Dr. Chuck Francis	22
	25	26 No Class	27	28 Crop Day in Crawford	29 NSAS WORKSHOP OGALLALA 8:30 - 5:00 TOMORROW
<b>February</b>	1	2 Anthropological Views of Agriculture	3	4 Anthropological Views of Agriculture	5
	8	9 Economics and Sustainability	10	11 Economics and Sustainability	12
	15 SRM	16 Meetings	17 Albuquerque	18 New Mexico	19 ----->
	22	23 International Examples	24	25 International Examples	26
<b>March</b>	1	2 Pest Management	3	4 Pest Management	5
	8 Spring	9 Break	10 No	11 Classes	12 ----->

	15	16 Private vs. Public Soil Testing	17	18 Minimum Tillage Soil Management	19
	22	23 Irrigation Systems	24	25 All Day Field Trip to Sidney - Alternative Crops	26
	29	30 Grazing Practices	31	1 Grazing Practices	2 No Classes
April	5	6 Nebraska Sustainable Agriculture Society	7	8 Nebraska Sustainable Agriculture Society	9 No Classes
	12	13 Case Studies	14	15 Case Studies	16
	19	20 Future of and Converting to Sustainable Ag	21	22 Future of and Converting to Sustainable Ag	23
	26	27 Take Home Exam	28	29 Take Home Exam	30
May	3 Finals	4 Week	5 _____	6 _____ 10:00 - 12:00 Exams Due	7 _____>

AG344.CAL

9/9/91

**POSITION PAPER DRAFT - For Comment Only****Long-Term, Integrated Education in Agroecology****Background**

Growing concern about the importance of interactions and systems is leading many academics in agriculture to consider new and integrative directions in teaching. Without minimizing the continuing value of improved components of systems, there is an emerging awareness of environmental, resource, and social dimensions of current systems. In a world of increasingly scarce resources and growing demand for food, it is time to analyze the efficiency and impact of crop and crop/livestock systems. We have responded at UNL with formation of a Center for Sustainable Agricultural Systems. In Latin America there are new programs in Agroecology, from Mexico to Argentina, and from Chile to Cuba. Agronomists and others throughout the Americas have captured the broad context of agricultural systems, and have begun to incorporate this concept into their Colleges of Agriculture. What follows is a proposal to begin the integration of greater emphasis on systems into the curriculum in Agronomy and the CASNR in Nebraska.

**Proposal**

A series of five courses is proposed to introduce, provide an overview, and bring together concepts on Agroecology within the CASNR curriculum; three of these courses already exist in the curriculum and two are new courses.

**Specific Courses in Sequence****Agriculture 100: Agroecological Systems (2 units)**

This course is currently taught by Don Edwards, assisted by Jim King and Chuck Francis, and introduces first year students to systems methodology, to departments and activities in CASNR, and to the importance of components as parts of agricultural systems.

**Agronomy 100: Biology of Agroecosystems (proposed, 3 units)**

A team-taught course is proposed for first year students that will introduce concepts of renewable and non-renewable resources, inputs and outputs of systems, biological interactions among system components, environmental inputs of alternative systems, and the economic and social consequences of agricultural and livestock systems. A list of topics is attached (tentative - Appendix A).

**Agronomy 101: Crop Components of Agricultural Systems (3 units)**

This course is currently taught by Rick Waldren, assisted by Patti Boehner, and deals with the most important components of Nebraska cropping systems. Under continuous revision, the course is growing to reflect several dimensions of international agriculture and sustainable systems.

**Agriculture 389: Agroecological Concerns Seminar (1 unit)**

This would be a course with name change from "Agricultural Concerns Seminar" run by the FACTS organization, could be taken two times for credit in the second, third or fourth years, and would be coordinated by Chuck Francis and others. It would continue to pull together topics of general interest such as research and extension paradigms, alternative agricultural groups in Nebraska, outside speakers and panels on a range of topics, and envisioning the future in agriculture.

**Agronomy 410: Advanced Agroecology (proposed 3 units)**

A new senior level course, this "capstone" activity would be team-taught by faculty associated with the Center for Sustainable Agricultural Systems, and would pull together ideas gleaned by students from their prior experience and courses over the first three years. Highly participatory in nature, the course would deal with philosophy of agriculture; world systems, resources and climate; connections between agriculture and rural development; and the role of food and agricultural systems in future human endeavors. A list of topics is attached (tentative - Appendix B).

**Summary**

Comments are invited on this proposal, and any suggestions on how it might be implemented as UNL in the CASNR.



## APPENDIX A

### Agronomy 100: Biology of Agroecosystems (tentative topics)

1. Inventory of renewable and non-renewable resources within a watershed, inputs and outputs, human and other needs in area.
2. Evolution of agroecological systems, world population, human migrations and resource use.
3. Structure of agroecosystems, including components, principle interactions, trophic levels, products of systems.
4. Physiological and ecological processes in agroecosystems such as energy flow, nutrient cycles, diversity, competition and mutualism.
5. Development and production of alternative agroecosystems, changes over space and time, effects of climate and inputs, system stability.
6. Optimum use and conservation of natural resources, use of ecological principles, homeostasis, and maintaining long-term production and balance with the environment.
7. Conceptualizing agroecosystems and measuring system performance, including yields, income, resource and environmental dimensions, and social consequences and quality of life associated with alternative systems.

## APPENDIX B

### Agronomy 410: Advanced Agroecology (primary ideas from Altieri, 1991)

1. Agroecological systems in different regions of the world, including their history, resource use, profitability, and sustainability.
2. Resources available for agriculture, relationships among human populations, land, water, energy, and other resources, demand for and distribution of food.
3. Environmental impacts of modern agriculture, pesticide and nitrate accumulations, erosion, multiple demands of society for resources.
4. Concepts and dynamics of agroecosystems, climate and agriculture, nutrient cycling, energy flow, water cycles, biological control.
5. Biology and management of soils, role of legumes, soil organic matter and compaction, fertilizer versus fertility.
6. Ecological management of weeds, insects, pathogens and nematodes, interactions among biotic agents, interactions with water, nutrients and cultural management.
7. Ecology and management intensity of farms and ranches of different sizes, locations and resource endowments.
8. Alternative agroecosystems such as polyculture, agroforestry, rotations, cover crops, living mulches and permaculture.
9. Organic agriculture, theory and practice in Nebraska and elsewhere, biodynamic systems, French intensive and others.
10. Impact of alternative agricultural systems on rural income, infrastructure, quality of life, and stability.
11. Methods for analysis of agroecosystems, including yields, net income, resource dimensions, ecological/environmental costs, and sustainable product and income.
12. Political dimensions of agroecosystems, government programs, world markets.
13. Future agricultural systems and their impact on human and other species' populations, resource dimensions, global environmental impacts.

Ref: Altieri, M.A. 1991. Incorporando la agroecologiz al curriculo agronomico. Presented in meeting of CLADES, Santiago de Chile, September 2.

**ALTERNATIVE AGRICULTURE CURRICULUM  
THE UNIVERSITY OF VERMONT**

- A. Fine Arts and Humanities: 6 credits (Art, Classics, Theater, Music, Philosophy, Religion)
- B. Communication skills: 6 credits (English, Communications and Public Address, Foreign Languages)
- C. Social Sciences: 6 credits (Anthropology, Geography, History, Political Science, Psychology, Sociology)
- D. Analytical skills: 6 credits
  - 1. One course in mathematics (MATH 9) or Statistics 111
  - 2. One course in computers (CS 3 or VOTC 85)
- E. College of Agriculture and Life Sciences "Beginnings" course
- F. "Race and Culture" course
- G. Physical Education: 2 credits (1 recommended: PEAC 052 Hatha Yoga)
- H. Chemistry: one course inorganic (CHEM 1, 3, or 11), one course organic (CHEM 4, 42, or 141)
- I. Soil: three required courses (\*), two recommended
  - 1. PSS 161 Introductory Soil Science\*
  - 2. PSS 162 Soil Fertility and Management\*
  - 3. PSS 210 Soil Erosion and Conservation\*
  - 4. PSS 261 Soil Conservation and Land Use
  - 5. PSS 197 Environmental Soils
- J. Plant: four required courses (\*), choice of any other three
  - 1. PSS 11 Principles of Plant Science\*
  - 2. FOR 73 Small Woodland Management\*
  - 3. BOT 104 Physiology of the Plant Body\*
  - 4. PSS 122 Small Fruit Crops
  - 5. PSS 124 Ecological Vegetable Production
  - 6. PSS 138 Commercial Plant Propagation
  - 7. PSS 141 Forage Crops
  - 8. PSS 197 Farming Internship\* (12 weeks in 1 summer)
  - 9. PSS 197 Agroecology
  - 10. PSS 217 Pasture Production and Management
  - 11. PSS 221 Tree Fruit Culture

**K. Animal: any two courses**

1. ASCI 1 Introductory Animal Science
2. ASCI 43 Fundamentals of Nutrition
3. ASCI 110 Principles of Animal Feeding
4. ASCI 113 Livestock Production

**L. Pests: four required courses**

1. BOT 117 Plant Pathology or  
FOR 134 Forest Pathology
2. PSS 106 Insect Pest Management or  
PSS 107 Forest Entomology
3. FOR 231 Integrated Forest Protection or  
PSS 232 Biological Control of Insect Pests
4. PSS 215 Weed/Crop Ecology

**M. Agricultural Economics: any two courses**

1. AREC 61 Agricultural and Resource Economics
2. AREC 166 Small Business Management
3. AREC 177 Alternatives for Vermont Agriculture
4. AREC 196 Economics of Sustainable Agriculture
5. AREC 201 Farm Business Management
6. AREC 207 Markets, Food, and Consumers
7. ENVS 195 Environmental Economics

**N. Ecology: any two courses**

1. ENVS 1 Introduction to Environmental Studies I
2. FOR 120 Forest Ecology
3. BOT 160 Plant Ecology
4. PSS 197 Holistic Resource Management/Permaculture

**O. Vocational Education and Technology: any two courses**

1. VOTC 2 General Shop and Small Engine Repair
2. VOTC 6 Energy Alternatives
3. VOTC 20 Metalworking Technology
4. VOTC 30 Woodworking Technology
5. VOTC 35 Welding and Metal Fabrication
6. VOTC 131 Light Frame Buildings
7. VOTC 132 Building Construction Laboratory
8. VOTC 162 Building Utility Systems

**P. Sociopolitical: any two courses**

1. AREC 002 World Food, Population, and Development
2. AREC 171 Agriculture in Economic Development
3. PSS 197 Agriculture in the Third World

# Sustainable Agriculture

**Bachelor of Science**

Contact: Matt Liebman, Coordinator &amp; Asst Professor

Department of Plant, Soil, and Environmental Sciences

University of Maine

5722 Deering Hall

Orono, Maine 04469-5722

Phone: (207) 581-2926

**Program**

The Sustainable Agriculture curriculum is an interdisciplinary program that combines courses in engineering, applied economics, animal science, plant protection, and plant and soil science to face the challenges of agriculture. There are six concentrations: Sustainable Agriculture, Agribusiness and Resource Economics, Animal Veterinary, and Aquatic Sciences, Plant Protection, Plant Science, and Soil Science.

**Post-Graduate Study**

Related Master of Science Degrees and Ph.D. programs are offered.

**Entrance Requirements**

English	4 years
Algebra (I&II)	2
Plane Geometry	1
Science (chemistry or physics preferred)	2
History	1
Year-long Academic Electives	5.5-6

**Career Opportunities**

The Sustainable Agriculture Program offers students sound training in scientific principles and access to careers as farmers, educators, extension agents, soil conservationists, researchers, consultants, planners or policy analysts.

**Core Curriculum (76-83)**

The B.S. in Sustainable Agriculture requires satisfactory completion of at least 120 degree hours at a cumulative grade point average of not less than 2.0 in a course of study that conforms to the following curriculum:

Concentration Requirements	17-37
Free Electives	up to 24
Total hrs required to graduate	120

**Basic Sciences and Mathematics**

Computer Science 3

BIO 100 Basic Biology 4

*Choose 1:*

BCH 207/208 Fundamentals of Chemistry 8

CHY 111/112 General Chem I/II 8

CHY 113/114 Chemical Principles I/II 8

*Choose 1:*

BIO 451 Biometry 3

FTY 204 Stat Infer in Forest Res 3

MAT 232 Principles of Stat Inference 3

**Communications**

ENG 101 College Composition (C grade required) 3

ENG 317 Technical Writing 3

SPC 103 Fund of Public Communications 3

9

**Sustainable Agriculture: Overview**

PSE 105 Principles of Sustainable Ag 3

PSE445 Agricultural Ecology 3

6

**Pest Ecology & Management**

(NOTE: students electing the Sust Ag, Plant Protection, Plant Science or Soil Science concentrations must take INT450 and 482.)

*Choose 1 or both:*

INT 450 Agricultural Pest Ecology 3

INT 482 Pesticides &amp; The Environment 3

3-6

*Choose 1:*

MAT 114 Calculus for Business &amp; Economics 3

MAT 126 Analytical Geometry &amp; Calculus I 4

MAT 151 Calculus for Life Sciences I 4

20-21

## Core Curriculum *continued*

### Plant and Soil Sciences

PSE 100	Plant Science	4
PSE 101	Cropping Systems	4
PSE 140/141	Soil Science/Lab	4

### Animal Sciences

AVA 145	Animal Sciences	12
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### Agricultural & Resource Economics

#### Choose 1:

INT 110	Modern Economic Problems	3
ECO 120/121	Principles of Micro/Macro Econ	6

#### Choose 1:

ARE 371	Intro to Nat Res Econ & Policy	3
ARE 454	Production Economics	3
ARE 458	Resource Business Management	3
ARE 459	Resource-based Business Finance	3
ARE 471	Resource Economics	3
ARE 486	Government Policies Affecting Rural America	3
	Other Approved Course	3

### Bio-Resource Engineering

BRE 248	Engineering for Sust Agric	2
	Thematic Minor Electives	12

### Orientation

ASA 117	Issues & Opportunities	1
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### Total Core Curriculum Hours

76-83

### CONCENTRATION 1: SUSTAINABLE AGRICULTURE

Students electing concentration must take INT 450 & INT 482

AVA 445	Sustainable Animal Prod Systems	3
BOT 457	Plant Pathology	4
ENT 328	Introduction Applied Entomology	3
PSE449	Soil Organic Matter & Fertility	4
	Ecology credits	3

### CONCENTRATION 2: AGRICULTURAL & RESOURCE ECONOMICS

BUA 201/202	Accounting I/II	6
ARE 371	Intro to Nat Res Econ Policy	3
ARE 454	Intro to Production Economics	3
ARE 458	Agribusiness Management	3
ARE 459	Agricultural Business Finance	3
ARE 465	Food & Fiber Marketing	3
	Business and Economics Electives	9

### CONCENTRATION 3: ANIMAL, VET & AQUATIC SCIENCES

AVA 236	Physiology of Domestic Animals	3
AVA 260	Animal Genetics & Breeding	3
AVA 351	Animal Science Techniques	2
AVA 445	Sust Animal Production Systems	3
AVA 455	Animal Nutrition	3
AVA 462	Feed and Feeding Animals	2
ZOL 204	Animal Biology	4
	Choose 2:	
AVA 464	Feeding Swine & Poultry	1
AVA 465	Feeding Beef & Sheep	1
AVA 466	Feeding Dairy Cattle	1
AVA 467	Feeding Fish	2

#### Choose 1:

AVA 346	Dairy Cattle Technology	3
AVA 348	Livestock Management	3

#### Choose 1:

AVA 461	Animal Breeding	3
AVA 480	Physiology of Reproduction	3

28-29

### CONCENTRATION 4: PLANT PROTECTION

Students electing this concentration must take BCH207/208 (or equivalent) and both INT450 and 482.

BOT 201/202	Plant Biology/Lab	4
BOT 457	Plant Pathology	4
ENT328	Intro to Applied Entomology	4
INT 319	General Ecology	3
OR WLM 200		
ZOL 204	Animal Biology	4
	Choose 1:	
BOT 445	Plant Genetics	3
ZOL 462	Principles of Genetics	3
	Choose 4:	
BOT 452	Plant Physiology	3
BOT 464	Taxonomy of Vascular Plants	4
BOT 530	Biology of the Fungi	3
ENT 449	Insect Pest Management	3
ENT 460	Insect Biology and Taxonomy	3
ENT 461	Insect Biology, Taxonomy & Systematics	3
ENT 511	Insect Ecology	3
INT 555	Pest-Plant Interactions	3
PHY 111/112	General Physics/I/II	8
	Other Approved Course	4-37

### CONCENTRATION 5: PLANT SCIENCE

Students electing this concentration must take both INT450 and INT482.

AVA 445	Sustain Animal Prod Systems	3
BOT 452/453	Plant Physiology/Lab	4
BOT 457	Plant Pathology	4
ENT 328	Intro Applied Entomology	3
PHY 111/112	General Physics I/II	8
PSE 449	Soil Organic Matter & Fertility	4
PSE 479	Crop Physiology	4
	Choose 1:	
BOT 435	Plant Anatomy	4
BOT 445	Plant Genetics	3
BOT 464	Taxonomy of Vascular Plants	4
PSE 410	Plant Propagation	3
ZOL 462	Principles of Genetics	3

33-34

### CONCENTRATION 6: SOIL SCIENCE

Students electing this concentration must take both INT450 and INT 482.

AVA 445	Sust Animal Prod Systems	3
BOT 457	Plant Pathology	4
ENT 328	Intro Applied Entomology	3
PHY 111/112	General Physics I/II	8
PSE 146	Land Use Planning-Soil Aspects	2
PSE 440	Soil Chemistry & Plant Nutrition	4
PSE 442	Soil Taxonomy	3
PSE 449	Soil Organic Matter & Fertility	4
	Choose 1:	
GES 541	Glacial Geology	3
PSE 444	Soil Morphology & Mapping	3

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AnPI 3010  
**ENVIRONMENT AND WORLD FOOD PRODUCTION**  
Winter 1993

Introduction

The future of humankind depends on the earth's capacity to produce sufficient food, feed and fiber. Rising population and declining natural resources cause some to question whether contemporary agricultural systems can continue to sustain our planet.

Understanding ways in which the environment forms and constrains agroecosystems in the production of food, feed and fiber, as well as ways these systems impact the environment is important for any citizen. This course provides students with an introductory knowledge of major agricultural systems of the world and their ecology as well as with the opportunity to engage contemporary environmental dilemmas involving agriculture.

Course description

Introduction to agricultural systems of the world and their relation to the environment; ecology of plant/animal domestication; agroecosystem form and function in relation to environment; biodiversity within agroecosystems; macro- and microenvironmental influences on agricultural plants and animals; interdependence of natural resources and agricultural systems; agriculture and contemporary environmental dilemmas.

Objectives

Upon completion of this course students will:

1. Understand how plants and animals change as a consequence of domestication.
2. Understand the process of agricultural system development in relation to environmental and cultural factors.
3. Be familiar with major agricultural systems of the world and their ecological characteristics.
4. Be able to define biodiversity within the context of agroecosystems.
5. Be able to describe how macro- and microenvironmental factors influence agricultural plants and animals, as well as the form and management of agroecosystems.
6. Be able to describe options for resolving contemporary environmental and natural resource dilemmas involving agroecosystems.

Course outline

*Unit 1 Agriculture, Food and Environment: an Overview*

*Unit 2 Ecology of Domestication/Agricultural System Development*

*Unit 3 Agroecosystems of the World*

*Unit 4 Interrelationships of Agricultural Plants and Animals with the Microenvironment*

*Unit 5 Interrelationships of Agroecosystems with the Macroenvironment*

*Unit 6 Biodiversity and Agroecosystems*

*Unit 7 Agroecosystems and Natural Resources*

**Evaluation**

Two mid-term exams and final = 350 points (no make-up exams given)

Decision case response analyses (5) = 250 points

Interact assignments = 100

Total = 700 points

**Grade standards:**

A = 92%+ of total points

B = 84 -91%

C = 70-83%

D = 60 -69%

F = < 60%

S = > 69%

**Instructor: Dr. Steve Simmons**

**204 Borlaug Hall**

**St. Paul Campus**

**625-3763**



### TENTATIVE SCHEDULE

**January 5**

## Orientation to course

## Unit 1 lecture: Agriculture, Food and Environment

**Readings**

- Crossan, 1992, *Sustainable Agriculture*
- Reganold et al, 1990, *Sustainable Agriculture*
- Rhodes, 1991, *World's Food Supply at Risk*

**Assignment: Environmental impacts of food**

7

## Unit 1 lecture: Agriculture, Food and Environment

### **Interact: Environmental impacts of food**

12

## Unit 2 lecture: Ecology of Domestication

**Readings**

- Cox/Atkins, 1979, (Chpts 2,3,4)
  - Ecosystem Concept*
  - Evolution of Agricultural Systems*
  - Ecology of Domestication*
- Goodman, 1988, *Evolution of Maize*
- Maloney, 1991, *Origin of Rice*
- Smith, 1989, *Origins of Agriculture in E. North America*
- Tivy, 1990, *The Agroecosystem* (Chapt 1)

## Unit 2 guest lecture: The Domestication of Wild Rice

(Dr. Erv Oelke)

**Reading** • Oelke, 1991, *Wild Rice*

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## Unit 2 guest lecture: The Domestication of Animals

**(Dr. Mike White)**

**Readings** • Cox/Atkins, 1979, *Ecology of Domestication* (Chapt 4)  
• Tivy, 1990, Chapt 7 *Domestic Livestock*

## Video: Wolf in the Fold

**Assignment: Polecat Bench decision case**

**Reading** • Chechile, 1991, *Intro to Environmental Decision Making*

## Assignment: The Mystery of Chaco Canyon

19

## Unit 2 lecture: Agricultural System Development

**Readings**

- Jackson, 1990, *Agriculture with Nature as Analogy*
- Scarisbrick, 1989, *Rapeseed*
- Wagoner, 1990, *Perennial Grains*

## **Interact: The Mystery of Chaco Canyon**

**Reading** • Lekson, 1988, *Chaco Canyon Community*

- 21      Discussion: Polecat Bench case  
          Unit 3 lecture: **Agroecosystems of the World**  
                  Readings    • Cox/Atkins, 1979, Chapt 5 *Subsistence Agriculture*  
                                  • Kirkby, 1990, *Ecology of Traditional Agroecosystems*  
                                  • Marten, 1990, *Agriculture in S.E. Asia*  
          Assignment: Agricultural landscapes-out of the ordinary
- 26      Unit 3 lecture: **Agroecosystems of the World**  
                  Readings    • Buttel, 1989, *Soc. Relations and Growth of Modern Agric.*  
                                  • Geisler, 1991, *Impact of Dairy Restructuring*  
          Interact: Agricultural landscapes-out of the ordinary  
                  Reading    • Gaskell, 1991, *Agricultural change and environmentally sensitive areas*
- 28      Exam 1  
          Assignment: Agriculture and Global Climate Change  
                  Readings    • CAST, 1992, *Preparing U.S. Agric. for Global Climate Change*  
                                  • Maunder, 1989, *Climate Var. and Agric. Prod. in Temperate Regions*  
                                  • Parry, 1990, *Climate Change and its Implications for Agriculture*  
          Assignment: Gustavson Farm decision case
- February 2      Unit 4 lecture: **Agric. Plant-Microenvironment Interrelationships**  
                  Readings    • Cox/Atkins, 1979, Chapt. 15, *The Nature of Agric. Pest Problems*  
                                  • Gould, 1991, *Evolutionary Potential of Crop Pests*  
                                  • Hall, 1989, *Physiological Ecology of Crops in Relation to Light, Water and Temperature*
- Discussion: Gustavson Farm case  
          Assignment: Heavy Metal Veggies decision case  
          Section #1 only: Overview of mentoring project  
                          (guest resources: Dr. Ann Duin and Liz Lammers)

- 4      **Unit 4 guest lecture: Agric. Animal-Microenvironment Interrelationships (Dr. Mike White)**  
         Reading    • Robertshaw, 1981, *Environmental Physiology of Animal Production*  
         Discussion: Heavy Metal Veggies case  
         Section #1 only: Coordination of mentoring project
- February 9      **Unit 5 lecture: Interrelationships of Agroecosystems and the Macro-environment**  
         Reading    • Rice/Vandermeer, 1989, *Climate and the Geography of Agriculture*  
         Interact: Agriculture and global climate change
- 11      **Unit 6 lecture: Biodiversity and Agroecosystems**  
         Reading    • Myers, 1989, *Loss of Biological Diversity and its Potential Impact on Agriculture and Food Production*  
                     • Pimentel et al, 1989, *Risks of Genetic Engineering in Agriculture*  
                     • Prescott-Allen, 1990, *How many plants feed the world?*  
         Assignment: Jari decision case  
         Reading    • Cook, 1990, *Global effects of Tropical Deforestation*  
                     • Repetto, 1990, *Deforestation of the Tropics*
- 18      **Unit 6 guest lecture: Genetic diversity in soybean (Dr. Jim Orf)**  
         Video: **Seeds for Tomorrow**  
         Assignment: The Trees of Sogolonbougou decision case
- 23      **Unit 6 lecture: Biodiversity and Agroecosystems**  
         Reading    • Oldfield/Alcom, 1987, *Conservation of Traditional Agroecosystems*  
                     • Nair, 1990, *Agroforestry: An Approach to Sustainable Land Use in the Tropics* (Chapt 14)  
         Discussion: Jari case  
         Assignment: Kangaroos, Suckers, Grass and Water: Conflicting Values
- 25      Discussion: The Trees of Sogolonbougou case  
                 (guest resource: Georgia McPeak)  
         Interact: Kangaroos, Suckers, Grass and Water: Conflicting Values  
         Section #1 only: Coordination of mentoring project

- March 2      Assignment: Selenium and the San Joaquin Valley decision case  
                  Reading      • Ellis, 1991, *Harvest of Change*  
                  Exam 2
- 4              Unit 7 lecture: **Agricultural Systems and Natural Resources**  
                  Reading      • Buringh, 1989, *Availability of Agricultural Land for Crop and Livestock Production*  
    • Hillel, 1991, (Chapts 11, 19, 20)  
    *Silt and Salt in Mesopotamia*  
    *The Promise and Peril of Irrigation*  
    *Accelerating Erosion*  
                  Interact: Water and agriculture  
                  Reading      • Carrier, 1991, *The Colorado: A River Drained Dry*
- 9              Unit 7 lecture: **Agricultural Systems and Natural Resources**  
                  Discussion: Selenium and the San Joaquin Valley  
                  Assignment: Agricultural systems and the soil
- 11             Unit 7 lecture: **Agricultural Systems and Natural Resources**  
                  Interact: Agricultural systems and the soil  
    (resource: Dr. Deborah Allan)  
                  Course evaluation  
                  Section #1 only: Mentoring project evaluation
- Final exam:    Section 1: 1600-1800 Thursday, June 10  
                          Section 2: 1600-1800 Friday, June 11

## ISSUES IN SUSTAINABLE AGRICULTURE

Agronomy 445  
Environmental Studies 445  
(2 Credits)

## ADVANCED ISSUES IN SUSTAINABLE AGRICULTURE

Agronomy 545  
(3 Credits)

Fall Term 1993

Instructor: Ricardo J. Salvador  
1126 Agronomy Hall  
Office Hours: Friday 9:30-11:30 am

Phone: (515) 294-9595  
FAX: (515) 294-3163  
INTERNET: rjsalvad@IASTATE.EDU

<u>WEEK</u>	<u>TOPIC</u>
<b>CONCEPTUAL FOUNDATIONS</b>	
24 Aug	<i>Conventional and Sustainable Agriculture:</i> What is the difference? The political economies of subsistence systems. Reading: Tivy Ch. 14 "Intensive Agriculture," pp. 224-242; Ch. 15 "Agriculture and the Environment," pp. 243-260; Soule <i>et al.</i> IN Carroll <i>et al.</i> Ch. 6 "Ecological Impact of Modern Agriculture," pp. 165-188.
31 Aug	The concept of the <i>Agroecosystem</i> . Problem-solving via the "bigger hammer" approach. "Systems" methodologies. Rediscovering the wheel: the concept of Farming Systems Research. Reading: Tivy Ch. 1 "The Agro-ecosystem," pp.1-6; Wilson and Morren Ch. 1 "Managing Complexity and Change in Food, Agriculture, and Natural Resources," pp. 1-19.
<b>TRANSITION FROM ANIMAL-TRACTION TO MECHANIZED AGRICULTURE</b>	
7 Sep	Subsistence agriculture and production agriculture. A difference of scale or world-view? Environmental carrying capacity. Reading: Tivy Ch. 8 "Land Capability for Agriculture," pp. 134-145; Ch. 9 "Pastoral Farming," pp. 146-162; Toledo IN Altieri and Hecht, Ch. 7 "The Ecological Rationality of Peasant Production," pp. 53-60.
14 Sep	Objectives of tillage. Cropping systems ensuing from animal-traction. Industrial Revolution and the impetus for mechanization. Environmental impact of tillage. Soil conservation. Reduced tillage. Cover crops. Rotations. Terraces. Contours. Drainage practices. Reading: Tivy Ch. 4 "The Cultivated Soil," pp. 42-62; Jenny IN Jackson <i>et al.</i> ch: 4 "The Making and Unmaking of a Fertile Soil," pp. 42-55; Browse Tull (available in the Special Collections Room of the Parks Library). <b>AGRON 545: Dr. Richard Cruse</b>
21 Sep	Consequences of livestock in the agroecosystem: Energy cycles in the crop/livestock system, manure management. The primacy of the ecosystem. Reading: Tivy Ch. 7 "Domestic Livestock," pp. 115-133; Pimentel and Dazhong IN Carroll <i>et al.</i> Ch. 5 "Technological Changes in Energy Use in U.S. Agricultural Production," pp. 147-164; Levins and Vandermeer IN Carroll <i>et al.</i> Ch. 12 "The Agroecosystem Embedded in a Complex Ecological Community," pp. 341-362. <b>AGRON 445: INQUIRY 1.</b>

- 25 Sep (Saturday) Field trip to Richard and Sharon Thompson farm, Boone Co. Guide: Mr. Rick Exner, Agronomy Extension/Practical Farmers of Iowa.  
Reading: Thompson *et al.* IN Francis *et al.* Ch. 9 "Case Study: A Resource-Efficient Farm with Livestock," pp. 263-280; National Research Council Ch. 5 "Crop-Livestock Farming in Iowa: The Thompson Farm," pp. 308-323.

### CHEMICAL AGRICULTURE

- 28 Sep Demographics, Green Revolution, the "greater yields" syndrome, and the stimulus for production agriculture. Reductionist science and the scientific basis of fertilizer application: crop plant mineral nutrition.  
Reading: Tivy Ch. 6 "Agricultural Productivity," pp. 90-114; Wright IN Jackson *et al.* Ch. 11 "Innocents Abroad: American Agricultural Research in Mexico," pp. 135-152. National Research Council Ch. 3 "Research and Science," pp. 141-164; Black IN CAST Ch. 6 "Crop and Soil Sciences," pp. 68-78.
- 5 Oct Fertility rites: Tull, Liebig, Blackman. Fertilizer response curves. The black art of fertilizer recommendations. Fate of applied fertilizing substances. Nitrogen cycle. Eutrophication of natural waterways.  
Reading: Tivy Ch. 5 "Nutrient Cycling," pp. 63-89.  
AGRON 545: Dr. Alfred Blackmer
- 12 Oct Nitrate and phosphorus pollution of groundwater. The point-source controversy. Case history: Herman Warsaw and 370 bu. of corn/acre. Agriculture gone amuck or hope for the future?  
Reading: Jarrell IN Carroll *et al.* Ch. 14 "Nitrogen in Agroecosystems," pp. 385-412.
- 19 Oct Weed management strategies. Evolving philosophies: management versus elimination. Advantages and disadvantages of mechanical/cultural control of weeds. Crop physiological ecology: the place of weeds in a cropping system. How the "successful" herbicide has changed: 2,4-D, atrazine, glyphosate. Herbicides and the environment. Effects on non-target people, plants, and places.  
Reading: Vandermeer Ch. 3 "The Competitive Production Principle," pp. 29-45; Ch. 4 "Facilitation," pp. 47-67; Ch. 8 "Weeds and Intercrops," pp. 127-140; Harlan Ch. 4 "What is a Weed?" pp. 83-104; Liebman and Janke IN Francis *et al.* Ch. 4 "Sustainable Weed Management Practices," pp. 111-143.  
AGRON 545: Dr. Robert Hartzler

### TOWARD A MORE SUSTAINABLE AGRICULTURE

- 26 Oct Early technological revisionism: Conservation Farming, Reduced Tillage, Integrated Pest Management. Biotechnology: A sustainable technology or a bigger hammer? Genetic diversity. The deception of alternative crops: using "new" species in old ways.  
Reading: Andow and Rosset IN Carroll *et al.* Ch. 15 "Integrated Pest Management," pp. 413-440; Salick and Merrick IN Carroll *et al.* Ch. 19 "Use and Maintenance of Genetic Resources: Crops and their Wild Relatives," pp. 517-548; Trenbath *et al.* IN Gliessman Ch. 20 "Threats to Sustainability in Intensified Agricultural Systems: Analysis and Implications for Management," pp. 337-365.  
AGRON 445: INQUIRY 2.
- 2 Nov Water management. Irrigation and (*miracle* / *folly*) in the desert.  
Reading: Tivy Ch. 12 "Dryland Agriculture," pp. 196-208; Ch. 13 "Irrigation Agriculture," pp. 209-223.
- 9 Nov No Class

- 16 Nov Lessons from the third world: 1000 years of agriculture in China, Peru, Mexico. Intercropping, crop rotation, terracing.  
Reading: Tivy Ch. 10 "The Humid Tropical Lowlands," pp. 163-183; Ch. 11 "Rice," pp. 184-195; Marten IN Altieri and Hecht Ch. 19 "Small-Scale Agriculture in Southeast Asia," pp. 183-202; Brush IN Altieri and Hecht Ch. 17 "Crop Development in Centers of Domestication: A Case Study of Andean Potato Agriculture," pp. 161-172.  
AGRON 445: Research Project Due  
AGRON 545: Dr. Jon Sandor
- 30 Nov Farmers who are putting their livelihoods on the line to practice sustainable agriculture: convictions, experiences and lessons.  
Reading: Logsdon IN Jackson *et al.* Ch. 1 "The Importance of Traditional Farming Practices for a Sustainable Modern Agriculture," pp. 3-18; Andrews *et al.* IN Francis *et al.* Ch. 10 "Converting to Sustainable Farming Systems," pp. 281-314; Butler Flora IN Francis *et al.* Ch. 12 "Sustainability of Agriculture and Rural Communities," pp. 343-360.  
AGRON 445: Doug Alert, Ron and Maria Rossman, Tom Frantzen

### PHILOSOPHY AND AGRICULTURE

- 7 Dec Economics, human equality, global sustainability.  
Reading: Lockeretz IN Francis *et al.* Ch. 15 "Major Issues Confronting Sustainable Agriculture," pp. 423-438; Francis IN Francis *et al.* Ch. 16 "Future Dimensions of Sustainable Agriculture," pp. 440-466; Buttel IN Carroll *et al.* Ch. 4 "Social Relations and the Growth of Modern Agriculture," pp. 113-146; Berry IN Jackson *et al.* Ch. 2 "Whose Head is the Farmer Using? Whose Head is Using the Farmer?" pp. 19-30.  
AGRON 545: Drs. Gordon Bultena and Eric Hoiberg
- 14 Dec AGRON 445: FINAL INQUIRY

### EVALUATION

(445):	Attendance/Participation:	60 %
	"Take-home" inquiries (3):	30 %
	Research Project:	10 %
(545):	Discussion Leadership:	25 %
	Discussion participation:	25 %
	Written summaries:	50 %

### COURSE RESOURCES

- TEXTBOOK: Tivy, Joy. 1990. *Agricultural Ecology*. Longman Scientific and Technical, Wiley, New York.
- COURSE PACKETS: One for 445 (discussion outlines)  
Two for 545 (discussion outlines, journal articles)  
Available from: Kinko's, 114 Welch Ave., Ames.
- ELECTRONIC NEWSGROUPS: On Usenet (available through Vincent, VAX & HDS):  
ALT.SUSTAINABLE.AGRICULTURE  
BIT.LISTSERV.ECOLOG-L  
SCI.ENVIRONMENT  
TALK.ENVIRONMENT

**SUPPLEMENTARY REFERENCES:**

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- Wilson, K. and G. E. B. Morren, Jr. 1990. *Systems Approaches for Improvement in Agriculture and Resource Management.* Macmillan.

AGRO 440  
Crops, Soils, and Civilization

Summary Activity

Our task today is to "design" a perfect agriculturally-based civilization. This should be done by reflecting on the principal attributes, both physical/biological and human, of the cultures which we have studied this semester. As you design this civilization, consider these sorts of questions: What attributes most favored the success of these cultures? What characteristics imposed significant restrictions on the cultures? What attributes contributed to the rise and later decline of the cultures? What attributes are required for long-term agricultural sustainability? In short, what can we say about the future of agriculturally-based civilizations such as our own based on what we have learned from the past? Based on your group's discussion, outline the attributes that you as a group view as essential for a "perfect" and sustainable agriculturally-based civilization. Be prepared to defend your conclusions about the required characteristics for a perfect agriculturally-based civilization.

Physical/Biological Attributes:

Climate  
Topography  
Water  
Climax community  
Crop diversity  
Soil quality and characteristics  
Crop rotational systems  
Crop origins

Human Attributes:

Governmental form  
Community structure  
Farm size  
Land ownership patterns  
Contact with foreign cultures  
Trading relationships  
Social organization  
Class structure  
Military affairs  
Individual rights  
Religious life  
Intellectual development

Note: Feel free to add any other attributes to the above lists that are appropriate.

## SYLLABUS

### Crops, Soils, and Civilization

AGRO 440 (3 credits)

1:45-3:00 TTh, 1104 H.J. Patterson Hall

Instructors: Bruce R. James, Soil Science, 0206 HJP, X 5-1345  
David J. Sammons, Crop Science, 1124 HJP, X 5-1340

#### Course Description:

Readings, lectures, and discussions will engage students in an in-depth, interdisciplinary study of the role and importance of crop and soil resources in the development and persistence of human civilizations. Agriculture is an integral part of human activities, using plants and soils for food, feed, and fiber production. Although of fundamental importance today, agriculture is a relatively recent human innovation; it began 10,000 to 12,000 years ago. Since that time, civilization as we know it has arisen, and human cultures have developed to the point that we cannot conceive of survival without agriculture. Nevertheless, agricultural activities are fundamentally disruptive of natural ecosystems. Does agriculture lead to its own destruction and that of the civilization it supports? Or can agricultural systems continue to change and improve so that indefinite productivity and human welfare are maintained? This course will explore these sorts of questions from the perspectives of the crop and soil sciences, and in historical contexts through a series of case studies.

#### Course Requirements and Grading System:

Each student will be expected to participate in class discussions of the four case studies that will be presented by the instructors during the semester. Two hour examinations, a term paper, and a final will also be required.

Students will have the opportunity to earn up to 1000 points during the semester, and a numerical average will be calculated and used to determine letter grades. The following points will be assigned:

<u>Requirement</u>	<u>Number</u>	<u>Points</u>	<u>Total Points</u>
Hour Exams	2	200	400
Final Exam	1	300	300
Paper	1	300	300

Readings for the course have been compiled from various sources by the instructors, and they may be purchased as a prepared booklet at Bel-Jean Copy Print Center. The address is 7415 Baltimore Blvd in College Park.

## Lecture Schedule

Date	Topic	Instructor
1/22 to 2/5	Pre-agricultural Human Societies Historical Origins of Agriculture Crop Evolution and Domestication	Sammons
2/7 to 2/21	Conversion of Grassland to Cropland Irrigation and Water Relations of Soils Soil Erosion and Conservation	James
2/26	The Nature of "Civilization" - Discussion of Lowdermilk paper	James/Sammons
2/28	Hour Exam #1	
3/15 3/7 3/12	<u>Fertile Crescent/Mesopotamia</u> : Overview Crops Soils	James Sammons James
3/14 3/19 3/21	<u>Greek and Roman Period</u> : Overview Crops Soils	James Sammons James
4/2	Synthesis and Review	James/Sammons
4/4	Hour Exam #2	
4/9 4/11 4/16 + 18	<u>Mayan Culture</u> : Overview Crops Soils	Sammons Sammons James
4/18 23 4/23 25 4/25 30	<u>Anasazi Culture</u> : Overview Crops Soils	Sammons Sammons James
4/30 5/2	Synthesis and Review	James/Sammons
5/2 7 5/7 9	<u>Future Perspectives</u> : 5/7 ← Crops Soils	Sammons James
5/9	Review [Create a Civilization]	James/Sammons
5/16	Final Examination, 10:30-12:30, 1104 HJP	

## **AGRONOMY 440**

### **Crops, Soils, and Civilization**

#### **Term Paper**

The following guidelines are provided to help you select a suitable and manageable topic for the term paper which is required in this course. Please spend some time reading outside materials before deciding on your topic, and please clear the topic with Drs. James and Sammons before you begin to research and write it. An outline of your paper with a title and at least five references (with an abstract of each) is due on February 19. This will be reviewed and approved by Drs. James and Sammons, and returned to you with our thoughts and suggestions. The term paper is due on April 25, and will count 30% of your semester grade.

A good place to begin to think about your topic is with material in the collected readings which you have. You should also browse through related materials in the University libraries to acquaint yourself with the available material on a topic which you are considering. Be imaginative in your choice of topic, and be careful to choose one that interests you sufficiently to hold your interests through the semester. Please make a particular effort to focus your topic as specifically as possible so that you can build depth into the content. The paper should not be simply a restatement of material already discussed in class. Both Dr. James and Dr. Sammons will be available to review your topic with you to help you sharpen the focus if you are having difficulty.

**As you start to select a topic, please review the following guidelines:**

- 1) The topic should be clearly connected to the themes and ideas discussed in this course.
- 2) The topic may be comparative in nature; that is, it may compare/contrast a particular feature of two historical cultures with reference to cropping systems, soil management, or social attributes relative to agriculture.
- 3) The topic may be analytical in nature; that is, it may focus on a particular problem (e.g., soil salinity, water management, crop evolution, cropping systems) within a culture, and analyze in depth the causes of, reasons for or attributes of that problem.
- 4) The topic may explore the social institutions associated with the agriculture of a particular historical group, relating those institutions to the characteristics of the agricultural economy of the group.
- 5) The topic may be specifically related to one of the four cultures with which this course is concerned, or it may discuss another historical culture.
- 6) An appropriate length for the paper is 10-12 typed pages (double-spaced), excluding the bibliography.

AGRONOMY 440

Crops, Soils, and Civilization

Reading List

**Pre-agricultural Human Societies**

- pg. 1-10 1. Price and Brown, Chap. 1. Aspects of hunter-gatherer complexity (623-690)  
11-30 2. Henry, Chap. 14. Preagricultural sedentism  
31-46 3. Harlan, The Golden Age

**Historical Origins of Agriculture**

- 47-55 4. Cohen, The Problem of Agricultural Origins  
57-64 5. Heiser, The Origin of Agriculture  
65-77 6. Harlan, Views on Agricultural Origins

**Crop Evolution and Domestication**

- 79-88 7. Darlington, The Coming of Agriculture  
89-100 8. Harlan, The Dynamics of Domestication

**Conversion of Grassland to Cropland**

- 101-125 9. Odum, Development and Evolution of the Ecosystem

**Irrigation and Water Relations of Soils**

- 127-147 10. Russell, The Management of Irrigated Saline and Alkali Soils

**Soil Erosion and Conservation**

- 149-185 11. Russell, General Principles of Soil Management

**Nature of "Civilization"**

- 187-202 12. Lowdermilk, Conquest of the Land Through 7000 Years  
(691-706)

**Mesopotamia**

- 203-265 13. Oppenheim, Ancient Mesopotamia. Portrait of a Dead Civilization  
267-276 14. Harlan, Near Eastern Center  
277-282 15. Harlan and Zohary, Distribution of Wild Wheats and Barley  
286-294 16. Dale and Carter, Mesopotamia



### Greek-Roman Period

- 296-393 17. Cary and Haarhoff. Life and Thought in the Greek and Roman World  
395-420 18. White, Roman Farming  
421-479 19. Dale and Carter, Greece; Italy and Sicily

### Mayan Culture

- 481-504 20. Thompson, Prologue to Rise and Fall of Maya Civilization  
505-527 21. Willey and Shimkin, Maya Collapse  
529-550 22. Simmons, Evolution of Crop Plants: Maize, Cacao, Beans, and Cucurbits ✓  
551-618 23. Flannery, Chaps. 6-8. Maya Subsistence (707-713)

### Anasazi Culture

- 619-633 24. Hurt, Indian Agriculture in America  
635-645 25. Ambler, Anasazi Prehistoric People (715-725)  
647-665 26. Berry, Age of Maize in Greater Southwest  
667-681 27. Rohn, Prehistoric Soil and Water Conservation

**Slippery Rock University**

**FACT SHEET**

**SUSTAINABLE SYSTEMS  
Parks and Recreation/  
Environmental Education  
Graduate Coordinator  
101 Eisenberg Building  
(412)738-2068**

### **MASTER OF SCIENCE IN SUSTAINABLE SYSTEMS**

The Master of Science in Sustainable Systems is a thirty-five hour program. It is available under a thesis or non-thesis program.

Admission to the program is open to anyone who meets the general admission requirements for graduate study at Slippery Rock University with an undergraduate cumulative grade point average of at least 3.0 (on a 4 point scale). In addition, each applicant must submit a portfolio outlining involvement in relevant prior study/activities and at least two letters of recommendation describing the applicant's competence and effectiveness in a professional setting.

Students who lack sufficient undergraduate preparation may be required to complete a non-credit reading program or meet other requirements prior to admission to degree candidacy.

### **DEGREE OBJECTIVES**

Slippery Rock's Master of Science in Sustainable Systems is the only one of its kind in the United States. It was conceived by the late Dr. Robert Macoskey, Professor of Philosophy at Slippery Rock University. Through the Alternative Living and Energy Research Project (ALTER), Dr. Macoskey created an educational program for all persons interested in the relationship of human ecology to the environment and the natural systems found there.

Nature now exhibits warnings that the systems we have established based on anthropocentric thinking are not sustainable. As we recognize this we are obliged to seek ways to bring our human made systems into harmony with nature. This degree provides an unprecedented opportunity for students to respond to this challenge. Building sustainable societies may be the most pressing, yet rewarding task we now face.

The four tracks of this degree program - Agroecology, Built Environment and Energy Management, Permaculture, and Resource Management - collectively focus on designs which draw their inspiration from the diversity, stability and resilience inherent in nature. The integration and human ecology fuses the many course offerings and practical experiences offered in the MS3 program. Students develop an understanding of this integration through creative problem solving exercises, laboratory and field experience. They interact with a highly skilled and motivated faculty dedicated to the spirit of inquiry, research and imaginative approaches to education. Our goal is to develop problem solving and communication skills needed to share with others our vision of a sustainable society.

### **HARMONY HOMESTEAD**

An on-campus homestead serves as host to a variety of

activities associated with the MS3 program and ALTER. Harmony House has been renovated for energy conservation, utilizing alternative energy technologies, allergy-free/non-toxic design techniques and material recycling. The larger homestead combines the elements of shelter, energy, and landscape in a harmonious and sustainable permaculture design. All aspects of this design are intended to foster appropriate interrelations and interactions between all systems in an ever-evolving method of human scale development. Permaculture, as a core component of the MS3 program, offers the student an ethical background in the principles and techniques for creating the integration of landscape and people. Through the conscious design of agrosystems which mimic the diversity, stability and resilience of natural ecosystems we demonstrate the provision for food, energy, shelter and other material and non-material human needs in a sustainable way.

#### **COURSEWORK**

The Master of Science in Sustainable Systems is a 35 credit hour interdisciplinary program involving permaculture design and applied ecology in addition to the graduate level emphasis on research methods, analysis of literature, and the option of a thesis or a six credit internship. Each student is required to take 20 credit hours of core courses and 15 hours of coursework specific to a chosen track.

## THE CURRICULUM

### Professional Core (Required of all MS3 majors) Credits

BIOL 555	Field Ecology or PREE 550 Applied Ecology	3
PREE 640	Principles and Techniques of Permaculture Design	
PREE 613	Analysis of Professional Literature	3
PREE 799	Research Methods	3
PREE 740	Sustainable Systems Seminar	2
PREE 699	Internship (Non-Thesis)	
	OR	
PREE 800	Thesis	<u>6</u>
		20

### Agroecology (Sustainable Agriculture)

PREE 642	Sustainable Agriculture Techniques	3
PREE 643	Sustainable Agriculture Processes in Plant and Animal Husbandry	3
PREE 644	Fertility Considerations	3
	Electives	<u>6</u>
		15

### Built Environment/Energy Management (Ecoarchitecture)

PREE 661	Design and Resource Development for Energy Conservation	3
PREE 662	Allergy-free/Non-toxic Design	3
PREE 663	Alternative Energy & Engineering for Sustainable Systems	3
PREE 676	Site and Building Feasibility Studies	3
	Elective	<u>3</u>
		15

### Permaculture

Complete any 5 Agroecology, Built Environment/Energy Management, Resources Management, or Elective courses relevant to the student's career goals. 15

### Resources Management

Currently under revision.

### Elective Courses

PREE 541	Design Graphics & Problem Solving
PREE 612	Open Space Planning
PREE 646	The Quest for Permaculture
PREE 647	Cultural models in Permaculture
ECON 610	Economics of Sustainable Systems
GEOL 630	Man and His Physical Environment

Graduate Assistantships are available and include a tuition waiver and stipend (\$4,000 in 1992-93). Unconditional admission to graduate studies is a prerequisite for assistantship eligibility. Assistantships may be awarded for up to two academic years with recipients working 20 hours per week and scheduling at least nine semester hours. Application forms may be obtained through the Office of Graduate Studies and Extended Programs and are to be submitted to the departmental graduate coordinator in the field where the prospective graduate student intends to major or to the administrative head of the unit in which a position is sought.

#### **GRADUATE FACULTY IN SUSTAINABLE SYSTEMS**

Paul Baroutsis, PhD. Economics. Economics of sustainable systems

Thomas DeLuca, Ph.D. Soils and agroecology

Paulette Johnson, MS. Environmental Education. Ecology

Robert Kobet, IA, MS. Alternative Energy and Engineering. Allergy-free/non-toxic design, design and development for energy conservation

Larry Patrick, PhD. Permaculture and animal husbandry, certified organic farmer

W.G. Sayre, PhD. Chemistry. Fertility considerations of sustainable agriculture

William Shiner, PhD. Resources management

Dale Stewart, PhD. Site design for energy conservation, open space planning

COURSE OUTLINE

Course Title: Design and Resource Development for Energy Conservation

Course Code: 71 661

Course Hours: 3 Semester Hours

Course Description: Site and detail scale facility and landscape design for energy conservation from a natural resources inventory, through programming for design, concept evolution and preparation of conceptual site and structure plan, profiles and construction details, including project supervision.

Course Competencies: Upon completion of the course, students will be able to:

1. Define terms and recall major facts associated with limited scale facilities planning and development for energy conservation.
2. Identify the process and sequence of project design and development.
3. Develop manual graphic skills necessary to produce simple design schemes for various facility planning projects.
4. Analyze relationships of natural and man-made site elements and activities programming to the design and development of energy conserving facilities.
5. Synthesize information from site and program analyses to develop conceptual plans, sections and details for selected facilities.

Evaluation: Site Analysis and Concept projects, conceptual structure and site plans, profiles and details projects, graphic and oral presentations.

Course Activities: Lectures, class discussions, design assignments, lab exercises.

Course Outline:

1. Week 1. Overview of course objectives, content, materials, references and evaluation. Foundations of design for energy conservation. The design cycle.
2. Week 2. Research and regional influences. Graphic presentations techniques. Site selection and base sheet construction.
3. Week 3. Microclimate, existing features, slope aspect and inclination analysis.

4. Week 4. Soils, vegetation, hydrography analysis. Assignment of first project: Site Inventory and Analysis.
5. Week 5. Inventory and Analysis graphics and site visits. Student critiques.
6. Week 6. Presentation and jury for first project. Introduction to programming for energy conserving design. Site and structural enlargements.
7. Week 7. Sensory and spatial relationships. Program resource requirements. Energy input and energy output. Assignment of second project: The Concept and Relationship Diagrams.
8. Week 8. Development of relationship diagrams and energy loops. Student critiques.
9. Week 9. Presentation and jury for second project. Conceptual site and structure planning. Plan view symbolism.
10. Week 10. Cross section and profile construction. Assignment of third project: Conceptual plans, sections profiles and project detailing and cost estimate.
11. Week 11. Professional resources and contract development.
12. Week 12. Project supervision.
13. Week 13. Plan, section, profile, and detail graphic presentation technique, computer aided design. Student critiques.
14. Week 14. Presentation and jury for third project.
15. Week 15. Submit cost estimate.

### Bibliography:

- \* 1. Building Design and Construction, Periodical 1/9/51 to Present, Chicago
- \* 2. Buildings, Energy Conservation Congress, International PLEA Conference, Rethimnon, Crete. Passive and low Energy Architecture. Laboratory for Architectural Science and Environmental Research, Oxford, New York, Pergamon Press, 1983
- \* 3. Cheny, Robin, L.A. Fill 89, American Society of Landscape Architects Foundation, Washington, D.C., 1989
- \* 4. Coen, Duane, Nassauer, Joan, Tuttle, Ron, Latis X: Landscape Architecture in the Rural Landscape, American Society of Landscape Architects, Washington, D.C., 1987
- 5. Conway, Gordon, Resource Development in Southeast Asia, New York, Ford Foundation, 1973
- \* 6. Davis, Shelton and Nartsy, Jeremy, Resource Development and Indigenous Peoples, A Comparative Bibliography, Boston, Massachusetts, Anthropology Resource Center, 1983
- \* 7. Dietrich, Norman, Cost Data for Landscape Construction, 10th Ed., Kerr Associates, Minneapolis, MN 1989
- \* 8. Doyle, Michael E., Color Drawing, NY, Van Nos Reinhold, 1981
- \* 9. Dubin, Fred S. and Long, Chalmers C., Building Energy Conservation, New York, McGraw Hill, 1978
- \*10. Energy and Development. International Conference on the Economics of Energy and Development. Boulder, Colorado, 1974
- \*11. Energy Conservation - A National Forum Celan Energy Research Institute, University of Miami, Coral Gables, Florida, 1976
- 12. Farnque, Oman, Graphic Communication as a Design Tool, NY, Van Nos Reinhold, 1984
- \*13. Ferguson, Bruce K., Index to Landscape Architecture Magazine, Mesa, AZ, PDA Publishers, 1988
- \*14. Former, Penney, Buildings, Energy Conservation Bibliography, Turvey, England, Scholium International, 1983
- \*15. Glasstone, Samuel, Energy Deskbook, Oak Ridge, Tennessee, Technical Information Centers U.S. DOE, 1982
- \*16. Harris, Charles, and Dines, Nicholas, Time-Savers Standards for Landscape Architects, NY, McGraw, 1988



- \*17. Landphair, Harlowe, and Klatt, Fred, Landscape Architecture Construction, Elsevier, NY, NY, 1979
- \*19. Lee, Kaimen, Buildings Energy Conservation Case Studies, Environmental Design and Research Center, 1977
- 20. Lynch, Kevin and Hack, Gary, Site Planning, 3rd Ed., Cambridge, MA, MIT Press, 1984
- 21. McHarg, Ian, Design with Nature, 2nd Ed., Garden City, NY, Doubleday, 1971
- \*22. McPherson, Gregory, Energy Conserving Site Design
- \*23. Pollack, Franklin S., Resources Development - Frontiers for Research, Western Resources Conference, University of Colorado Press, 1960
- \*24. Reiter, Sydney, Buildings, Energy Conservation Costs, New York, Van Nostran, Reinhold, 1985
- \*25. Resource Development and Engineering Conference, National Cheng Kung University, Tainan, Taiwan, 1987
- 26. Rubinstein, Harvey, A Guide to Site and Environmental Planning, 3rd Ed., NY, Wiley, 1987
- 27. Simonds, John O., Earthscape, NY, Van Nos Reinhold, 1986
- 28. Simonds, John O., Landscape Architecture, NY, McGraw, 1983
- \*29. Walker, Theodore, Plan Graphics, Mesa, AZ, PDA Publishers, 1985

**SLIPPERY ROCK UNIVERSITY  
DEPARTMENT OF PARKS, RECREATION AND ENVIRONMENTAL EDUCATION  
MASTER OF SCIENCE IN SUSTAINABLE SYSTEMS**

**COURSE:     ALTERNATIVE ENERGY AND ENGINEERING FOR  
              SUSTAINABLE SYSTEMS**

**INSTRUCTOR:     MR. KOBET**

**COURSE DESCRIPTION:**

This course will present a variety of energy and building engineering systems which are environmentally sound, ecologically sensitive and appropriate for allergy-free/nontoxic living. The issue of environmental sustainability will be discussed in concert with the engineering and application of building energy systems. Emphasis will be placed on renewable energy sources, natural energy flows, climatology and human ecology as system design determinants.

**COURSE OBJECTIVES:**

To understand building energy consumption, natural energy flows in structures, the impact of microclimates on building energy system selection and sizing, the importance of energy conservation, renewable energy systems and environmental sustainability. Equal emphasis will be placed on research, analysis, calculations and hands-on application of energy related systems at Harmony House. The use of equipment to measure energy flows and daylighting will be included.

**COURSE TEXTS:**

Solar Design Manuals (by instructor)  
L.O.F. Daylighting Handout (by instructor)  
Solarizing Your Present Home  
The Passive Solar Design Book

**COURSE EVALUATION:**

Evaluation will be a combination of tests, quizzes, report and research papers. Equal emphasis will be placed on written assignments, verbal presentations and seminar participation. Type and frequency of evaluation method is the discretion of the instructor. Quizzes may be unannounced. The student is responsible for all aspects of the evaluation procedure.

**SLIPPERY ROCK UNIVERSITY  
DEPARTMENT OF PARKS, RECREATION AND ENVIRONMENTAL EDUCATION  
MASTER OF SCIENCE IN SUSTAINABLE SYSTEMS**

**ALTERNATIVE ENERGY AND ENGINEERING FOR  
SUSTAINABLE SYSTEMS**

**PAGE TWO**

**COURSE CHRONOLOGY:**

Week One:	Course discussion and introduction to natural light
Two:	Solar geometry and natural light
Three:	Natural light calculations and measurements
Four:	Building energy consumption
Five:	Building energy consumption and conservation
Six:	Passive solar design - direct gain
Seven:	Passive solar design - sunspaces
Eight:	Passive solar design - indirect gain
Nine:	Passive solar design project
Ten:	Active solar systems
Eleven:	Active solar systems
Twelve:	Photovoltaic systems
Thirteen:	Photovoltaic and wind systems
Fourteen:	Hydroelectric
Fifteen:	Final project/seminar and review

**COURSE EQUIPMENT AND SUPPLIES:**

Notebook and/or binder for handouts  
24" wide roll of tracing paper  
18x24 sheets of vellum

**COURSE POLICY:**

Attendance is mandatory.  
The professor retains the right to reject late work.  
If late work is accepted, the student forfeits the right to prompt return of the same.  
The student must submit copies of the work and retain originals.  
Participation in Harmony House projects, if any, is mandatory.

SLIPPERY ROCK UNIVERSITY  
DEPARTMENT OF PARKS, RECREATION AND ENVIRONMENTAL EDUCATION  
MASTER OF SCIENCE IN SUSTAINABLE SYSTEMS (MS3)

COURSE: ALLERGY-FREE/NONTOXIC DESIGN 71-302

INSTRUCTOR: MR. KOBET

COURSE DESCRIPTION: ;

This course will acquaint the student with the concept of human ecology as a design determinant and the relationships of man to the built environment. Emphasis is placed on understanding the influence of the built environment on our mental and physical well being and the ethic of sustainability as it relates to human habitat and evolution. Participants will learn to assess existing structures and planned new construction for potentially harmful incitants of environmental illness. Benign material substitutes and alternative building methods for constructing healthy environments is included.

COURSE OBJECTIVES:

To gain an understanding and appreciation of our physiological relationship to the built environment, the nature and causes of environmental illness, human ecology as a design determinant and the creation of an awareness of what constitutes healthy human habitat. The student will learn how to scrutinize structures for the sick building syndrome and identify incitants of chronic illness. The relationship of building enclosures and mechanical systems will be examined to establish their synergistic relationship to building function.

COURSE TEXTS:

Your House, Your Health and Well Being  
Rea and Rousseau  
Healthy House  
John Bower  
Selected readings and class handouts

COURSE EVALUATION:

Evaluation will be by combination of tests, quizzes, written assignments, research papers, seminar presentations and participation in projects at the Harmony House. The type and frequency of evaluation device is the discretion of the professor. Quizzes may be unannounced. The student is responsible for all aspects of the evaluation procedures.

**SLIPPERY ROCK UNIVERSITY  
DEPARTMENT OF PARKS, RECREATION AND ENVIRONMENTAL EDUCATION  
MASTER OF SCIENCE IN SUSTAINABLE SYSTEMS (MS3)**

**ALLERGY-FREE/NONTOXIC DESIGN**

**PAGE TWO**

**COURSE CHRONOLOGY:**

Week One:	Course introduction, human ecology and the built environment
Two:	Human ecology and environmental illness
Three:	The sick building syndrome - causes and cures
Four:	Seminar research and presentations
Five:	Allergy-free/nontoxic design, site planning issues
Six:	Site planning, foundation design
Seven:	Building enclosures, thermal and moisture protection
Eight:	Interior finishes and plants
Nine:	Building systems
Ten:	Occupancy and maintenance
Eleven:	Residential evaluation and critique
Twelve:	Residential evaluation and critique
Thirteen:	Commercial evaluation and critique
Fourteen:	Commercial evaluation and critique
Fifteen:	Final projects and presentation

**COURSE EQUIPMENT AND SUPPLIES:**

Notebook and/or binder for handouts  
35 mm camera and/or video camera for VHS videotape format

**COURSE POLICY:**

Attendance is mandatory.  
The professor retains the right to reject late work.  
If late work is accepted, the student forfeits the right to  
a prompt return of the same.  
The student must submit copies of the work and retain  
originals.  
Participation in Harmony House Projects, if any, is man-  
datory.

Slippery Rock University  
Department of Parks & Recreation/  
Environmental Education

P. Johnson  
9/93

**APPLIED ECOLOGY FOR SUSTAINABLE SYSTEMS  
COURSE SYLLABUS**

**COURSE TITLE:** Applied Ecology for Sustainable Systems

**COURSE CODE:** 71-550

**CREDIT:** 3 semester hours

**COURSE DESCRIPTION:** This course is an integration of ecology, resource management and environmental education to promote an understanding of ecological principles as they relates to sustainability. Emphasis is placed on the application of ecological principles based on social value orientations as they apply to resource management practices.

**COURSE COMPETENCIES:**

1. Examine personal and societal values as they relate to land stewardship and sustainability.
2. Express basic ecological principles verbally and in writing
3. Ask clarifying and extending questions related to site specific environmental problems.
4. Recognize the complexity of natural systems.
5. Integrate ecological principles into a holistic approach to land use management.
6. Incorporate conservation practices for resource management.
7. Apply higher order thinking skills to solve environmental problems.
8. Recognize the importance of environmental education as a tool for sustainable living.
9. Predict ecological consequences to ecosystem disturbance in an effort to avoiding environmental conflict and degradation of resource structure.
10. Analyse statistical data and communicate the outcomes.
11. Justify solutions to site specific environmental problems by using models, known facts, and application of ecological principles.

**COURSE REQUIREMENTS:**

1. Class participation. An unexcused absences will result in the drop of one letter grade.
2. Completion of all assignments, including but not limited to:
  - a. laboratory reports
  - b. research paper
3. Completion of all quizzes and the mid-term and final tests.
4. Attend all field trips.
5. Complete all supplemental readings

**COURSE TEXT:**

1. Smith, R. (1990). *Ecology and Field Biology*. New York: Harper and Row.
2. Naess, A. (1990). *Ecology, Community and Lifestyle*. New York: Cambridge University Press.

**II. CLASS POLICIES**

A. Attendance: See department policy (accompanies syllabus)

B. Measurement, Evaluation and Grading:

1. Grading System

<u>Assignment</u>	<u>Percent</u>	<u>Points</u>
Lab reports	25%	100 pts.
Mid-term test	25%	100 pts.
Research paper	25%	100 pts.
Final test	<u>25%</u>	<u>100 pts.</u>
	100%	500 pts.

2. Grading Scale:
- |    |              |
|----|--------------|
| A= | 500-450 pts. |
| B= | 449-400 pts. |
| C= | 399-350 pts. |
| D= | 349-300 pts. |
| F= | 299- pts.    |

3. Quizzes may be announced in advance or unannounced.
4. Assignments MUST BE typed using high quality drawings or sketches to illustrate, as appropriate. The format and specific instructions will be provided when the assignment is discussed in class.
5. Make up quizzes and tests, based on excusable absence, are oral and given at the convenience of the instructor.
6. Field trips will be announced in advance. Attendance is mandatory.
7. Submission of unexcused-late-assignments will result in a 5% reduction of grade per day (including weekend days), not to exceed 20%. No late assignments will be accepted after November 24.

**TENTATIVE SCHEDULE:**

September	1	Expectations of the Class
		Preparation for wetlands field trip
	3	Lentic and Lotic Ecosystems
	8	Water Quality Analysis
	10	Wetlands field trip
	15	Pond Ecosystem Management
	17	Watershed Analysis
	22	Watershed Analysis (legislative breakfast)
	24	Forest Ecosystems
	29	Deciduous and Coniferous Forest Types
October	1	Population Ecology

	6	Population Lab: Sampling and Density Estimation
	8	Integrated Pest Management
	13	NO CLASSES, PROFESSIONAL DEVELOPMENT DAY
	15	Lab reviews
	20	Mid-term test (ECO-ED CONFERENCE IN TORONTO)
	22	Soil Ecology and Sustainability
	27	Soil Lab
	29	Introduction to Ecological Principles
November	3	Microclimate lab
	5	Flow and Sustainable Cycles
	10	Trophic Ecology of Humans Lab
	12	Test (PAEE conference)
	17	Sustainability and the Community Concept
	19	Behavior Patterning
	24	Sustainable systems
	26	NO SCHOOL, THANKSGIVING BREAK
December	1	Philosophy of Sustainability and Ecology
	3	Gaia hypothesis
	8	Deep Ecology
	10	Environmental Ethics and land stewardship



Course Title: Soils as a Resource

Course Code: 71590

Credit: 3 Semester Hours

Course Description: (1) Develop an understanding of the soil resource as an integral and pivotal component of agroecosystems and the living environment. (2) Develop a working knowledge of soils as a complex ecosystem and as part of a greater ecosystem.

Course Competencies:

1. Identify human relation to soils and historic patterns of soil abuse.
2. Describe and discuss soils as a complex system requiring a holistic approach to its proper management.
3. Describe basic processes that underline soil formation.
4. Use and interpretation of soil maps.
5. Identify basic aspects of soil chemistry, physics, biology, and biochemistry.
6. Outline soil management practices that sustain and enhance the soil resource.

Evaluation: Class participation, class assignments, quizzes, final exam.

Course Activities: Lectures, class discussions, field trips, media presentations, demonstrations.

Course Outline:

1. Introduction to course
2. Human relation to soils
3. Historic account of nature's response to soil abuse
4. Overview of soils as a complex system and need for holistic management
5. Soil genesis and morphology
6. Interpretation of soil maps

7. Soil physical properties
  - a. Water
  - b. Structure
8. Soil chemistry
  - a. Clay mineralogy
  - b. Chemical equilibria
9. Soil biology
  - a. Microbiology
  - b. Macrofauna
10. Soil biochemistry
11. Effects of management
  - a. Soil erosion
  - b. Soil physical properties
  - c. Soil biology
12. Course overview and summary

Required Text: Brady, M. C. 1990. Nature and properties of soils. McMillian, NY.

Bibliography:

1. Brady, M. C. 1990. Nature and properties of soils. McMillian, NY. 922 pp.
2. Foth, H. 1987. Fundamentals of soil science. John Wiley and Sons, NY. 436 pp.
3. Hillel, D. 1991. Out of the Earth. University of California Press. Berkeley, CA. 321 pp.
4. Paul, E.A. and F.E. Clark. 1989. Soil biology and Biochemistry. Academic Press, San Diego, CA. 273 pp.
5. Savory, A. 1988. Holistic Resource Management. Island Press, Cavelo, CA. 536 pp.
6. Tompkins, P. and C. Bird. 1989. Secrets of Soil. Harper & Row, NY. 444 pp.

## COURSE SYLLABUS

### FERTILITY CONSIDERATIONS IN REGENERATIVE AGRICULTURE

PREE 644S  
TR: 2:30-5:15

FALL 1992  
ECB 011

INSTRUCTOR: Mr. Ronald Gargas  
OFFICE: ECB 006D  
OFFICE HOURS: As posted and by appointment. PHONE: 738-2958

#### REQUIRED TEXTS:

McLeod, Edwin. Feed the Soil. Oak Park, MI: McLeod, 1982.

Fryer, Lee. The Bio Gardener's Bible. Radnor, PA: Chilton, 1982.

#### NATURE OF THE COURSE:

Soil Fertility in Sustainable Agriculture is the study of mechanical, biological, and stewardship methodologies employed to attain safe, cost-effective soil fertility. Soils are composed to two parts: inert minerals and soil life. The primary emphasis of the course will investigate how soil life, which processes, accumulates, and returns (decomposes) organic matter, can effectively lead to increased soil fertility.

#### COURSE REQUIREMENTS:

- Class attendance and participation
- Mastery of texts and lecture material
- Research paper - must be soil fertility related. (Topic approval by instructor by 9/15/92).

#### EVALUATION:

- Quizzes and class participation (25% of final grade)
- Midterm Exam 10/15/92 (25% of final grade)
- Research paper - due 12/3/92 (25% of final grade)
- Final Exam 12/17/92 (25% of final grade)

#### COURSE OUTLINE (By Topic):\*

- Introduction to Biological Soil Fertility
- Hands-on Tours/Biological Fertility Procedures
- Soil Types/Textures Influencing Soil Fertility

## COURSE OUTLINE (CONTINUED)

- Macro/Micro Nutrients
- Cover Crops/Green Manures
- Crop Rotations
- Composting
- Measuring Soil Fertility
- Forage Analyses as an Indication of Soil Health
- IPM Techniques/Considerations in Soil Health/Fertility
- Fertility Considerations in Horticultural/Agronomic Cropping Systems

\*Some topics may be covered more quickly (or slowly): depending upon the progress of class members and weather patterns. Lecture days/farm investigation days may be switched contingent on weather. The instructor reserves the right to modify (add or delete) material. Any and all material covered in texts, hand-outs, farm tours, etc. will be the basis for exam questions.

Plant and Animal Husbandry  
PREE 643

Spring Semester, 1993

Instructor: L. Patrick

Required Readings:

- Coleman, Eliot (1992). Four-Season Harvest. Port Mills, VT.:Chelsea Green Publishing Co.  
Steiner, Rudolf (1974). Agriculture. London:Bio-Dynamic Agriculture Association.  
Small Wright, Machaelle (1987). Behaving As If The God in All Life Mattered. Jeffersonston, VA: Pirelandra.  
Jeavons, John (1991). How to Grow More Vegetables. Berkeley: Ten Speed Press.  
Plus selected handouts.

- |      |     |   |
|------|-----|---|
| Jan. | 13  | Introductory comments.  |
|      | 20  | Concept of Husbandry and Oneness  |
|      | 27  | Oneness and Husbandry: ecology of biogas digesters                                |
| Feb. | 3   | Ken Hendrix visit from AgWay: the retail connection to plant and animal husbandry |
|      | [8] | Field trip to New Wilmington Livestock Auction                                    |
|      | 10  | <u>Machaelle Small Wright</u> Discussion  |
|      |     | Traci Lynn Darin visit from Pgh. G.C.F.B. on internship.                          |
|      | 17  | Rotational fencing with Doug, Baeley (Pioneer fencing).                           |
|      |     | Concept of rotational fencing with Kurt Achenback (Kencove Farm)                  |
|      | 24  | John Dawes from Huntingdon farm on AMBC   |
|      |     | Steiner, <u>Agriculture</u>   |
|      | 3   | Steiner, <u>Agriculture</u>   |
|      | [8] |   |
|      | 10  | Spring Break  |
|      | 17  | Spring Break  |
|      | 24  | Intensive Rotational Grazing field trip to Kencove Farms (plus calveing)          |
|      | 31  | Coleman, from Season Harvest  |
| Apr. | 7   | Coleman   |
|      | 14  | Field trip, heavy horse breeder   |
|      | 21  | (23-24) Field trip to Moore farm/Stolfus farm                                     |
|      | 28  | Jeavon, <u>How to Grow More Vegetables</u>  |
| May  | 5   | Jeavon, <u>How to Grow More Vegetables</u>  |
|      | 12  | Open  |

Student Evaluation:

Each student shall complete an independent project/paper to be determined in consultation with the instructor. The quality of this paper shall determine the student's final grade, although class attendance/participation and field trip participation shall be considered if need be.

Course Syllabus - 71-642S

Course Title: Sustainable Agriculture Techniques

Course Code: 71-642S

Course Description: Study of the application of low-impact sustainable agriculture practices which employ methodologies that are less harmful to our health, the health of farm workers and the environment.

Course Outline:

1. Course Intro/Orientation
  - a. Precepts/concepts of sustainable agriculture
2. Course Emphasis:
  - a. Review of ecological principles fundamental to sustainability
  - b. Introduction of agricultural practices utilized in sustainable food production systems including but not limited to:
    - Practical alternatives to conventional tillage
    - Crop rotation and soil building techniques
    - Weed/insect control practices in sustainable agriculture
    - Soil amendments permissible in organic food production
    - Planting, cultivation, harvest and storage of organic products
    - Meeting organic certification standards
3. Low-input, sustainable concepts will be demonstrated with a hands-on basis utilizing an already designed organic production farm where each student will be actively involved in an independent research project.

Course Competencies:

The student will be able to:

1. Define terms related to sustainable agricultural practices
2. Demonstrate their ability to identify and apply sustainable agricultural practices (lower input) which optimizes yield and reduces adverse consequences to the environment.
3. Demonstrate an ability to utilize practical cultivation/tillage practices resulting in soil building applications.
4. Demonstrate the ability to understand and apply concepts relating to planting, cultivation, harvest and storage of organic products.

5. Ascertain practical alternatives to chemical spray for weed/insect control/soil fertility.
6. Understand and practice principles fundamental to organic certification

Evaluation: Research paper, tests, mid-term and final exam

Course Activities: Lecture, hands-on field observation, classroom exchange, practical field exercise and the joy of discovery.

Seminars: (MANDATORY PARTICIPATION)

- |          |  |
|----------|--|
| 2/5-6/93 | Sustainable Agriculture Conference: Farming for the Future   |
| 3/10/93  | Gargasz Farms - Calving - Organic Beef Herd                  |
| 3/15/93  | Don Kretchman Farm/Bud Glendenning Farm - Greenhouse Starts  |
| March ?  | Ohio Ecological Food and Farm Association                    |
| 4/14/93  | Roman Stolfus Organic Chicken/Turkey Farm - Lancaster County |

Bibliography:

Agroecology: The Scientific Basis of Alternative Agriculture, Altieri, Miguel A.; The Guilford Press, New York, 1987

Dirt Rich, Dirt Poor: America's Food and Farm Crisis, Belden Joseph N., et al; Routledge & Kegan Paul, New York, 1986

People, Food and Resources, Blaxter, Kenneth; Cambridge University Press, Cambridge, 1986

Land Degradation: Problems and Policies, Chisholm, Anthony and Dumsday, Robert, Editors; Cambridge University Press, Cambridge, 1987

Groundwater Contamination in the United States, Patrick Ruth, et al; University of Pennsylvania Press, Philadelphia, 1987

Soil and Survival: Land Stewardship and the Future of America, Paddock, Joe, et al; Sierra Club Books, San Francisco, 1986

Journals:

Agriculture, Ecosystems & Environment  
 American Journal of Agricultural Economics  
 Outlook on Agriculture  
 The International Journal of Environmental Studies

Course Syllabus - 71643

Course Title: Sustainable Agricultural Practices in Plant Horticulture/Animal Husbandry

Course Code: 71-643

Credit: 3 credit hours

Course Description: The application of sustainable principles germane to organic plant production and animal rearing.

Course Outline:

1. Course orientation
2. Review precepts/concepts necessary for healthy plant/animal growth.
3. Techniques for enhancing soil nutrients pre-requisite to healthy plant/animal life.
  - a. Organic nutrients derived from composting
  - b. Green manure/cover crop, smother crops
  - c. Management of crop residues for mineral revitalization
  - d. Crop rotation practices/sequences
4. Permissible soil amendments in sustainable agricultural systems
  - a. Natural mined products
  - b. Foliar feeding
  - c. Low-input nutrient management
5. Pest management in sustainable agricultural systems
  - a. Natural controls
  - b. Biologicals
  - c. Importance of rotations in pest management
6. Environmental considerations for general herd health
  - a. Nutritional considerations of feed/supplements
  - b. Living conditions
  - c. Breeding conditions
7. Marketing and promotion of organic plant/animal production
  - a. Specialty crops
  - b. Organic beef, poultry, sheep, hogs
  - c. Audit trailing for organic authenticity
  - d. Promotion of certified organic meat



### Course Competencies:

1. To explore methods/materials appropriate for sustainable plant/animal production.
2. Demonstrate precepts/concepts of healthy plant/animal production without the use of synthetic fertilizers, herbicides and insecticides.
3. Demonstrate abilities to implement techniques resulting in increased organic matter/nutrient levels through the use of sustainable soil management practices.
4. Demonstrate abilities to identify and utilize natural soil amendments which have no harmful effects on either the soil system or ground water supply.
5. Demonstrate the ability to utilize natural plant/animal pest control.
6. Demonstrate the ability to utilize growing practices approved by organic certification programs to provide ready market access.

Evaluation: Independent study, testing, mid-term and final exam

Course Activities: Lecture, field discussions, assigned readings, independent studies and many hands-on associations with actual growing conditions.

### Bibliography:

Agriculture and the Environment in a Changing World Economy, Conservation Foundation, the Conservation Foundation, Washington, DC, 1986

State of the Environment: A View Toward the Nineties, Conservation Foundation, The Conservation Foundation, Washington, DC, 1987

Pests and Parasites as Migrants, Gibbs, A. J. and Meischke, H. R. C.; Cambridge University Press, Cambridge, 1985

The New Environmental Age, Nicholson, Max; Cambridge University Press, Cambridge, 1987

Comparative Farming Systems, Turner, B. L. and Brush, Stephen B.; The Guilford Press, New York, 1987

Towards Holistic Agriculture: A Scientific Approach, Widdowson, R.W.; Pergamon Press, 1987

### Journals:

American Journal of Agricultural Economics  
Farm Chemicals  
New Farm

Plant and Animal Husbandry  
FREE 71

Spring Semester, 1992

Instructor: L. Patrick

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Required Texts:

Coleman, Eliot (1989). The New Organic Grower. Chelsea Green, Chelsea, VT.

Fukuoka, Masanobu (1985). The Natural Way of Farming: The Theory and Practice of Green Philosophy. Japan Publications, Inc., Tokyo.

Gliessman, Stephen, ed. (1990). Agroecology: Researching the Ecological Basis for Sustainable Agriculture. Springer-Verlag, New York.

Skow, Dan (1991). Mainline Farming for Century 21. Acres, U.S.A., Kansas City, MO.

Small Wright, Maehaelle (1987). Behaving as of the God in All Life Mattered. Perelandra, Jeffersonton, VA.

Walters Jr., Charles and C.J. Penzau (1979). An Acres U.S.A. Primer. Acres U.S.A., Kansas City, Mo.

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Course Objective: To explore various schools of Thought on sustainable agriculture, to determine specifically the various perspectives held on plant and animal husbandry.

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Course Content

Theme

- I. Composting, via the Lubkes, leading to the Chambersburg conference on "Composting for the 21st Century". Readings on Pfieffer BD starters and the history of these starters.
- II. Scientific clarity to Plant and Animal Husbandry
  1. Astral clarity : Bio-dynamic farming -- lecture format.  
Premise: The universe streams through the creative farmer; plants and animals have intrinsic value.
  2. Cartesian clarity: Gliessman, read sequentially  
Premise: Farmers are avoided; plants and animals are givens.
- III. Non-Scientific clarity to Plant and Animal Husbandry
  1. Existential clarity: Coleman, read sequentially  
Premise: Farmers need themselves and their insights.
  2. Value-based clarity: Fukuoka, read sequentially  
Premise: No cause or effect exists.
  3. Trans-species partnership clarity: Small Wright, read sequentially  
Premise: Form is intelligent energy.
- IV. Revisiting Scientific Clarity to Plant & Animal Husbandry
  1. Religious clarity: Acres Primer & Skow (see below).  
Premise: Farmers are conduits for absolute truth.

**Readings:**

Primer  
Lessons 1-5  
6  
7-8  
9  
10-17  
19-20  
21-22  
23-26  
27  
28

Skow  
Chs. 4, 13  
1 & 2  
  
5  
3, 6, 8, 10 & 11  
12 & 14  
9 & 16  
  
15  
1 & 17

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**Course Requirements:** Each MS3 student must complete required readings, as assigned, and be prepared to discuss these readings in class. Each student shall identify "likes and dislikes: of the assigned materials, ask questions regarding these materials and offer critical commentary on issues raised.

A substantive term paper is also required. Topics for these papers will be determined in concert with the course instructor. (An early semester discussion should start to focus individual topics.)

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**Student Evaluation:** The quality of in-class participation shall bear on one-half the final grade. The remaining half shall be determined by qualities presented in the required term paper: succinctly written, clearly thought out, stylish, complete in literature search and degree of focus on the issue of sustainability in agriculture.

1. Course Title and Number Cultural Models in Permaculture FREE 71647

2. Semester Hours 3

11. Prerequisite - Both "Principles & Techniques of PC," FREE 71641 and "Quest for PC." FREE 61646

Cross-cultural comparisons are made of permaculture design. Models of indigenous permacultural techniques are compared with each other and with a variety of models employed in the industrial world. The millennial knowledge-base of traditional peoples living permaculturally amidst their plants and animals provides the basis for evaluating the permacultural viability of eco-villages, intentional communities, co-housing projects, and rebirth of metropolitan neighborhoods.

12. This course, "Cultural Models in Permaculture," is the last of three courses offered in permaculture at S.R.U. The metaphysics of permaculture and the hands-on skills required to make it successful--both covered in prerequisite courses--are combined here as students learn of and evaluate the kaleidoscope of permaculture techniques used in both North and South countries. The mental exercises pursued in "The Quest for Permaculture" join with the hands-on skills developed in "Principles & Techniques of Permaculture Design" to permit the MS3 permaculture student to look critically at the landscape design process on a global scale. An ability to critique this process needs to be expressed prior to the entry of our permaculture graduates into circles of professional responsibility.

13. Objectives of "Cultural Models of Permaculture"
- To raise the level of sensitivity toward the highly sustainable nature of indigenous communities worldwide.
  - To grasp, by means of primary research monographs, the technical aspects of permaculture design found in Southern countries.
  - To appreciate the cosmology held by those on earth who are capable of sustaining themselves.
  - To become knowledgeable on efforts in Northern countries to create permaculturally designed communities.
  - To weld both North and South Permaculture movements into a unified, global whole.

Competencies

- To be able to critique primary research monographs.
- To be able to enter Southern countries with an empathy toward their own sustainable resource base, and to share with peoples their the "best of the North" permaculture designs.
- Likewise, to be able to enter North countries' communities with an empathy toward their own sustainable resource base, and to share with peoples their the "best of the South" permaculture designs.
- To be able to model a permaculture design.
- To be able to design sustainable communities.

14. Evaluation

Participation in class discussion related to assignments given	20%
Mid-term written examination over materials covered	20%
Research Paper	30%
Final examination	30%

15. Lectures as needed to convey information-based material.  
Seminar group discussions of assigned readings.  
Mini-group evaluation of design projects of both North and South country origin.  
Research paper presentation by course participants.
16. Course Outline:
  - I. PREVIEW OF PREREQUISITE MATERIALS
    - A. from "Quest for Permaculture"
      - metaphysics of the permaculture paradigm
      - activism and permaculture
    - B. from "Principles & Techniques of Permaculture Design"
      - skills
  - II. PERMACULTURE AND COMMUNITY
    - A. Pursuing community
    - B. Pursuing settlement
  - III. MODELS OF INDIGENOUS PERMACULTURE: The South
    - A. Swidden
    - B. Aquatic polycultures: chinampas, So. China integrated cropping systems
    - C. Backdoor gardening, milpa
    - D. Tree-based polycultures: Chagga of E. Africa, Malaysia
    - E. Highland tropical systems: Altiplano raised beds, Ecuador, Nepal, Hawaii ahupua'a
    - F. In-field/Out-field systems, alleycropping
    - G. Hydrologic terraced systems: Bali, Philippines
    - H. Tribal vision as found in Asia, Africa, the indigenous Americas
  - IV. PLANNED MODELS OF PERMACULTURE: The North
    - A. The intentional community movement
    - B. Land Trusts
    - C. The Co-Housing Movement
    - D. Eco-village and Permaculture Design
    - E. Permaculture in the metropolitan area
  - V. PERMACULTURE IN THE METROPOLITAN REGIONS OF THE NORTH
    - A. Financing Urban Greening
    - B. Neighborhood planning: problems & challenges
    - C. Community Gardens
    - D. Urban farming
    - E. Cities as farms
    - F. Community-supported agriculture

Slippery Rock University

P.R.E.E. - MS3 curriculum

**Cultural Models in Permaculture**(3hr. course)

### Bibliography

Arhem, K. M. (in press). Portrait of a culture.

Bunch, R. (1985). Two ears of corn: A guide to people-centered agricultural improvement. Oklahoma City: World Neighbors.

Campbell, B. (1991). Agriculture and cooperation in a Himalayan village. Developing a sustainable world: Proceedings of the 4th International permaculture conference. Katmandu: Institute for Sustainable Agriculture Nepal.

Clarkson, J. D. (1968). The cultural ecology of a Chinese village. Chicago: University of Chicago.

Collier, G. A. (1975). Fields of the Tzotzil. Austin: University of Texas.

Felder, D. W. (1983). The best investment: Land in a loving community. Tallahassee, FL: Wellington.

Getz, A. (1991). Japanese organic farming and farmer-consumer co-partnerships. Developing a sustainable world: Proceedings of the 4th International permaculture conference. Katmandu: Institute for Sustainable Agriculture Nepal. (reprinted in Permaculture Activist, 25, 1991, December)

Gilman, D., & Gilman, R. (1991). Ecovillages and sustainable communities. Bainbridge Island, SW: Context Institute.

Handy, E. S. C., Handy, E. G., & Pukui, M. K. (1972). Native planters in old Hawaii: Their life, lore, and environment. Honolulu: Bishop Museum.

Hart, R. A. de J. (1984). Ecosociety: A historical study of ecological man. Dehra Dun, India: Natraj.

- Lindegger, M. O., & Tap, R. (1989). Conceptual permaculture report: Crystal waters village. Nabour, Queensland: Nascimanere.
- Lindegger, M. O., & Tap, R. (Eds.). (1986). Best of permaculture: A collection. Nabour, Queensland: Nascimanere.
- McCamant, K., & Durrett, C. (1988). CoHousing: A contemporary approach to housing ourselves. Berkeley: Ten Speed.
- Meyer, C., & Moosang, F. (1992). Living with the land: Communities restoring the earth. Philadelphia: New Society.
- Olkowski, H. et al. (1979). The integral urban house. San Francisco: Sierra Club.
- Olson, P. A. (ed.). (1990). The struggle for the land: Indigenous insight and industrial empire in the semi-arid world. Lincoln, NE: University of Nebraska.
- Reijntjes, C., Haverkort, B., & Waters-Bayer, A. (1992). Farming for the future. London: MacMillan.
- Schaffer, D. (1982). Garden cities for America: the Radburn experience. Philadelphia: Temple University.
- Smole, W. J. (1963). Owner-cultivatorship in middle Chile. Chicago: University of Chicago.
- Todd, J., & Todd, N. J. (1984). Bioshelters, ocean arks, and city farming. San Francisco: Sierra Club.
- Van der Ryn, S., & Calthorpe, P. (1991). Sustainable communities. San Francisco: Sierra Club.
- Walter, B., Arkin, L., & Calthorpe, P. (Eds.). (1992). Sustainable cities: Concepts and strategies for eco-city development. Los Angeles: Eco-Home Media.

Slippery Rock University  
Department of Parks and Recreation/Environmental Education  
Principles and Techniques of Permaculture Design  
Syllabus

Fall, 1992

Instructor: Ted Simanek - home phone #538-3911

Location: 011-ECB and Harmony House

Time: First Meeting 011-ECB, Saturday 9 a.m. - Noon

Text: Permaculture - "A Practical Guide for a Sustainable Future" by Bill Mollison, \$34.95.

Course Number: 71-641

Credits: 3

Course Description: This course is designed to develop a comprehensive understanding of the conscious design and maintenance of agriculturally productive ecosystems which have the diversity, stability and resilience of natural ecosystems. Special foci are placed on the harmonious integration of landscape and people providing their food, energy, shelter and other needs in a sustainable way.

Course Competencies:

1. Demonstrate knowledge of the natural systems which relate to regenerative agriculture, the built environment and resource management.
2. Analyze differences in various local and world climatic regions and their effect on the development of permanent sustainable systems.
3. Analyze social, economic and site considerations of sustainable systems.
4. Synthesize information and develop strategies for permaculture design in a variety of global settings.

Evaluation:

1. Project - Observation/Evaluation in Resource/Error Identification.
    - \* typical errors/problems at a design site
    - \* major or "Type I Errors"
    - \* resources and potential yields
    - \* stacking functions...technologies and processes producing multiple yields
- \*\*\* Project will be due at the beginning of the tenth class session (Nov. 14th) for presentations to class.



2. Mid-term exam - (take home) - questions on philosophy/ethics/concepts and themes/pattern understanding (students will have one week between classes 6 and 7 to complete exam).
3. Final exam - (take home) - complete between weeks 12 and 13; hypothetical design problem - site map and explanation of existing conditions. Students will identify problems/errors/limitations and suggest appropriate permaculture design applications. Final presentations - week 13 class period.

Performance Evaluation = 200 points:

A = 200 - 180 pts.	attendance = 30 pts.
B = 179 - 160 pts.	mid-term = 50 pts.
C = 159 - 140 pts.	project = 70 pts.
D = 139 - 120 pts.	final = 50 pts.

Weekly Content: The fourteen chapters of our text form the basis of our weekly content. Some chapters will receive more attention than others and so, the chapter numbers will not always coincide with the week of the semester. You should pay particular attention to reading these sections of our text.

Readings: Chapters/sections receiving emphasis in this course.

Chapter	Sections
1	1.1 thru 1.4
2	2.1 thru 2.5
3	3.1 thru 3.17
4	4.1 thru 4.28
5	5.1 thru 5.10
6	6.1 thru 6.7
7	7.1 thru 7.7
8	8.1 thru 8.22
9	9.1 thru 9.3/9.6 thru 9.9
10	10.1 thru 10.3/10.11
11	11.1 thru 11.5/11.13
12	12.1 thru 12.18
13	13.1 thru 13.3/13.8
14	14.1, 13.2/14.5, 14.6/14.9/14.12, 14.13

Schedule Note - There will be NO class session on the following Saturdays:

Oct. 24th - Conference  
Nov. 28th - Thanksgiving break

Requirements for Apprentice Permaculture Designer Certification

1. Successful completion of 3 credit course - Principles and Techniques of Permaculture Design (71-641).
2. Successful completion of 6 credit hours of research and project work leading to a completed permaculture design including:

- \* maps, sketches, photos, etc.
- \* resource identification
- \* site plans
- \* written report

All of the above can become a thesis.

3. Same as for #2 but on a non-credit individual basis beyond the MS-3 course content area for your degree.

CLASS SCHEDULE - Fall, 1992 - Saturdays - 9 a.m. - Noon

Sept. 5

12

19

26

Oct. 3

10- mid-term passed out

17 - mid-term due

24 - NO CLASS

31

Nov. 7

14 - Projects due - presentations

21

28 - NO CLASS (Thanksgiving break)

Dec. 5 - Final Exam passed out

12 - Final Exam due - presentations

Slippery Rock University  
Department of Parks and Recreation/Environmental Education

COURSE SYLLABUS

FREE 71 799 Research Methods

Spring, 1992

Instructor: L. Patrick

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REQUIRED READINGS:

Texts -

Gay, L.R. (4th ed.) 1987. Educational Research: Competencies for Analysis and Application. Macmillan Publishing Co., New York.

Glaser, Barney G. and Anselm. L. Strauss. 1967. The Discovery of Grounded Theory: Strategies for Qualitative Research. Aldine Publishing Co., New York.

Locke, Lawrence, Waneen Wyrick Spirduso and Stephen J. Silverman. 1987. Proposals that Work: A Guide for Planning Dissertations and Grant Proposals. (2nd ed.) Sage Publications; Newbury Park.

Papers -

Capra, Fritjof (1982) "The Systems View of Life," in Capra, Fritjof (1982). The Turning Point. Simon and Schuster, New York.

Carr, Wilfred and Stephen Kemmis (1986). "Action Research as Critical Educational Science," in Carr, Wilfred and Stephen Kemmis. (1986) Becoming Critical: Education, Knowledge and Action Research. The Falmer Press, London.

COURSE PURPOSE:

This course assists MS3 students to acquire basic knowledge about quantitative and qualitative research methods and to develop process skills enabling them to evaluate and do research. It extends Analysis of Literature toward the goal of writing a thesis or, alternatively, completing an internship with attendant project report and two professional papers.

COURSE CONTENT AND SCHEDULE:

Week 1. Introductory remarks, to include lecture reflecting content of required readings.

Assignment: Read Gay, Ch. 1; Capra; Locke, Spirduso and Silverman, Ch. 4; and Carr and Kemmis.

Write a first approximation of applying the research views of Gay; of Locke, Spirduso and Silverman and of Carr and Kemmis to the perspective on science offered by Capra. Answer, in written form, the questions pertaining to your personal goals in MS3 research. These answers are to be turned in for credit.

Week 2. Discuss written assignments.

Assignment: Read Gay, Ch. 2; Glaser and Strauss, Chs. 1 and 2; consult your Analysis of Literature paper, and answer provided questions regarding it. Answers are to be turned in for credit.

Week 3. discuss previous week's assignment.

Assignment: Create a hypothesis from your Analysis paper, or from another paper written by you.

Or,  
commence the process of creating a substantive theory from your Analysis paper or from another paper written by you.

Week 4. Already, we need a catch up week.

Week 5. Discuss hypothesis creation and discuss Grounded Theory.  
Assignment: Read Gay, Chs. 6 and 7. Complete guideline questions regarding these chapters.

Week 6. Discuss assigned guideline questions on historical and descriptive research methods.

Assignment: all read Gay, Ch. 3. Those tending toward qualitative research read Locke, Spirduso and Silverman, "Proposal 2: Qualitative Study, pp. 170-203. Qualitative oriented students also read Glaser and Strauss, Ch. 3. Write a refinement of your hypothesis. Also look at Gay, Chs. 4 and 5.

Or,

Those tending toward a quantitative research method, Read Gay, Chs. 4 and 5. Write a refinement of your hypothesis. Also look at Locke, Spirduso and Silverman, pp. 170-203 and Glaser and Strauss, Ch. 3.

Week 7. Discuss your individual research hypotheses, as now standing.

Assignment: All read Gay, Chs. 4 and 5. Answer guide questions pertaining to appropriate research instruments in sustainability. Resurrect your Week 1 paper on Capra's views on systems and update this paper, to include all previous weeks' materials.

Week 8. Discuss your second effort to use the research methods of Capra.

Assignment: Read Gay, Chs. 8 and 9; Glaser and Strauss, Chs. 4 and 5.

Week 9. Discuss concepts of quantitative and qualitative correlation and causation.

Assignment: Read Gay, Ch. 10; Glaser and Strauss, Chs. 6 and 7.

Week 10. Discuss concept of research experimentation.

Assignment: Present first draft of research methodology, as related to your hypothesis or Grounded Theory. This must reflect a qualitative or quantitative methodology.

Week 11. Read Gay, Ch. 14.

Assignment: Class-time review of computer software.

Week 12. Data Analysis; Read Gay, Ch. 12; Glaser and Strauss, Ch. 8.

Week 13. Data Analysis. Read Gay, Ch. 13.

Assignment: Build an analysis technique into your research process as a first approximation statement.

Week 14. Discuss individual analytical techniques, receive feedback from peers, and...

Assignment: Prepare final report of your research process.

Read: Gay, Chs. 15, 16 and 17; Glaser and Strauss, Chs. 9 and 10.

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#### STUDENT EVALUATION:

Weekly writing assignments will be graded on the basis of their content vis-a-vis the themes and principles of research methods discussed at the time of writing. A final research report will be due on the last day of class with no incomplete or late reports permitted. This research report shall reflect the assignments discussed weekly throughout the course: Problem selection, research method, data analysis and research evaluation. This final research report will serve some of you as the first draft of a thesis perspectus.

Analysis of Professional Literature  
PREE 613  
Course Syllabus

I. Course Objectives

1. To shift grammatically the adjective form sustainable to the verb form sustainability.
2. To explore this program's title.
  - a. What mode of science, or combination of modes, is most appropriate for the study of sustainability: modern, analytical science, and/or post-modern, non-linear science?
  - b. Which conceptualizations of a system are more appropriate for the study of sustainability: equilibrium systems, near equilibrium systems, or far-from-equilibrium systems.
3. To pursue sustainability via the evolution in thought from secular holism to spiritual holism
4. To move the discussion of sustainability beyond green prescription and beyond a particular kind of action, to explore the psychological dimensions of this movement
5. To interface with the related theme of research methods
6. To challenge each MS3 student to think critically about this issue of sustainability
7. To communicate more effectively as a writer and speaker; to arrive to live sustainability, to prepare one to leave the MS3 communal cocoon as a butterfly

II. Required Readings

1. Belitz, Justin (1991). Success: Full Living. Indianapolis: Knowledge Systems. ISBN 0-941705-17-X
2. Capra, Fritjof and David Steindl-Ract (1991). Belonging to the Universe. New York: Harper Collins Publishers. ISBN 0-06-250187-9
3. Griffin, David Ray (1988). The Reenchantment of Science. Albany: SUNY Press. ISBN 0-88706-785-9
4. Lemkow, Anna F. (1990). The Wholeness Principle. Wheaton: The Theosophical Publishing House. ISBN 0-8356-0655-4
5. Prigogine, Ilya and Isabelle Stengers (1984). Order Out of Chaos. New York: Bantam. ISBN 0-553-34082-4

### III. Student Responsibilities

- A. Work individually toward course objectives with the intent to empower oneself with the grace and commitment to sustainability.
- B. Work together, out of class, toward course objectives.
- C. Reflect on other coursework taken and incorporate that coursework when possible.
- D. Move beyond required readings and bring your personal agenda to class, complete with its literature.
- E. Share that literature.
- F. Be less concerned over a final grade.

### IV. Student Tasks

- A. On occasion, write structured thoughts on so-called guide questions used to identify course themes.
- B. Regularly compose unstructured thoughts regarding sustainability.
- C. Share these thoughts both in class and out of class to friends and instructor.

### V. Student Evaluation

Ultimately the dragon head of hierarchy must loom its head high. I must give each of you a final grade for Analysis. Fortunately, you can dream or sing away the dragon, or at least its fire. To do so, constantly express in and out of class the frustrations and delights you must be enduring as the course unfolds. Also, keep me in line as I attempt the same; be snipity within the professional community about you. Too, it helps to do the assignments.

### VI. Reading Assignments

Week 1          Didion

Weeks 2-3	The Classic Cartesian World:	Equilibrium Systems
	Prigogine	1-99
	Griffiths	1-47
	Lemkow	57-66

Week 4	The Modern Cartesian World:	Equilibrium Systems
	Prigogine	100-140
	Capra, Steindl-Ract	1-65
	Griffiths	57-69
	Lemkow	67-94
	Buckley	XIII-XXII
	Spenser	
	Jarvie	
	Kloman	

**Week 5-10    A Non-Cartesian World: Far-from-Equilibrium Systems**

Prigogine	140-209
Capra, Stendl-Ract	69-162
Griffiths	69-163
Lemkow	149-156
	95-149
	41-53
	171-217
	3-40
Belitz	1-60

**Week 11-13    A Cosmology of Sustainability**

Prigogine	213-313
Capra, Stendl-Ract	163-203
Griffiths	47-56
Lemkow	157-162, 217-298
Belitz	60-124
Gatto	
Brokchin	
Hill	

**Week 14-15    Presentation of Papers**

Slippery Rock University  
Department of Parks and Recreation  
Environmental Education

Fall 1993

**Course Title:**     Analysis of Professional Literature, PREE 613

**Credit:**       3 Semester Hours     **Instructor:** Tom DeLuca

**Office:**       208A Eisenberg

**Office Hrs:** 10:10 MWF, 8:40 TH

**Phone:**       738-2972

**Course Description:** An introduction to sustainable systems, the critical review of literature, and alternative approaches to the study of sustainability.

**Course Objectives:**

1. Explore the concept of sustainable systems and the purpose of our program.
2. Introduce the concept of critical review of literature and prepare well documented defensible arguments through extensive literature searches.
3. Discuss the concept of systems and how the concept has evolved.
4. Define or at least discuss an appropriate approach for the study of sustainability: Modern (reductionist), Post-modern (non-linear), Systems framework; Combination or middle ground.
5. Improve students ability to think and communicate the concepts of sustainability to ultimately effect change in a greatly newtonian world.
6. Prepare students to enter Research Methods and provide a foundation or background for initiating a prospectus.

<b>Evaluation:</b>	<b>Percent of Grade</b>
Class participation	10%
Written assignments	20%
Presentations	30%
Term paper	40%

**Course Activities:** Lectures, discussions, and field trips.



**Student Responsibilities:**

1. Work independently and together toward course objectives.
2. Bring professional literature to class to further discussion and debate.
3. Design studies or projects that test the sustainability of systems or its components.
4. Bring professional and academic experiences to class.

**Course Outline:**

Week 1: Introduction, discussion of backgrounds, identification of needs. The need for thorough literature review. Literature searches.

Week 2: Critical review of research and professional articles.  
Assign term paper topics

**\*\*Optional field trip to Penn State or Ohio State Library\*\***

Week 3: Presentation of critical reviews (from term paper topic)

Weeks 4-6: Sustainable systems as a concept (Orr and others)

Weeks 7-13: Pursuing an approach to study of sustainability (Odum, Prigogine, and others).  
Integration of approach(es)

Weeks 14-15: Presentation of papers.

**Readings from:**

1. Orr, D. 1992. Ecological literacy. SUNY Press, NY.
2. Prigogine, I, and I. Stengers. 1984. Order out of chaos: Mans new dialogue with nature. Bantum, NY.
3. Berry, W. 1977. Unsettling of America: Culture and agriculture. Sierra Club Books. San Francisco.
4. Campbell, A.B. 1993. Applied chaos theory: A paradigm for complexity. Academic press.
5. Odum, H.T. 1983. Systems ecology: An introduction. Wiley, NY.
6. Numerous professional and research articles.

## SYLLABUS

### Sustainable Systems Seminar PREE 699

Spring Semester, 1993

Instructor: L. Patrick

Required Readings: Condrary, Jace, ed. (1992). A Curriculum Transformation Resource. Women's Studies Program, Slippery Rock University; and Orr, David W. (1992). Ecological Literacy: Education and the Transition to a Postmodern World. Albany: State University of New York Press.

Course Objectives: to reflect systematically on the nature of sustainability, focusing particularly on its epistemology, and to create a pedagogy appropriate to a higher education sustainability curriculum.

#### Student Responsibilities:

1. Each student shall provide for one week a list of questions or directives to be addressed in class. These so-called initiatives are 1) to reflect the reading assignment made for that week, and 2) to give each seminar class a sense of structure. See below, Course Outline.
2. All students shall prepare very brief written position statements regarding these initiatives. These statements will guide in-class contributions.
3. Share your positions in class, as related to the initiatives created for that class.
4. Submit all written materials to the instructor on May 4.

Student Evaluation: Much of the Condrary text addresses the elimination of grade-related stress from the learning process. That goal is overtly sought in Seminar. Thus, meeting Student Responsibilities nos. 1, 2, and 4, above, will assure an A in Seminar. Other grades shall reflect less work.

Course Schedule:

Date	Initiatives by	Orr Reading	Condrary Reading
Jan 19	L. Patrick	Introduction to course	
26	L. Patrick	The Problem of Sustainability	Condrary Wells Soeder
Feb 2	<i>Yvette Orr-McKen</i>	Two Meanings of Sustainability	
9	<i>John Boyd</i>	A Tale of Two Systems: Sustainability in International Perspectives	Harris
16	<i>Cassandra Cole</i>	Fragments of Strategy	Wilkie/Thompson
23	<i>Ben McKean</i>	Ecological Literacy	Hathaway Anna
Mar 2	<i>John Patterson</i>	The Liberal Arts, the Campus, and the Biosphere: An Alternative to Bloom's Vision	Fontaine Mercede Rodriguez Milam
9		S P R I N G B R E A K	
16	<i>Peter Stark</i>	A Prerequisite to the Great Books of Allan Bloom: A Syllabus for Ecological Literacy	Woodyard Porrin
23	<i>Pamela Buttsche</i>	Place and Pedagogy	Porrin Cosgrove White
30	<i>Fleming Fallon</i>	Education and Sustainability: An Approach	

# Course Outline (con't)

Date	Initiatives by	Orr Readings	Condrary Reading
Apr 6	Mike Gable	What is Education For?	Goodwin, et al
13	Jack Soeco	Is Environmental Education an Oxymoron?	Anand
20	Barb Ruppert	Having Failed to Manage Our- selves, Will We Now Manage the Planet? An Opinion from the Back Forty	Lang
27		What Good is a Rigorous Agenda if You Don't Have a Decent Planet to Put it On (Apologies to Thoreau)	Carter Anderson
May 4		Food Alchemy and Sustainable Agriculture	Fitts France
		Epilogue	

Richard C. Grimm  
Financial Consultant  
(*green investment*)

## Butcher & Singer

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PARKS AND REC/ ENVIRONMENTAL ED  
Winter, 1991  
Sustainable Systems Seminar

SEMINAR PURPOSE: to extend your talents beyond the Fall Semester;  
to use these talents as you read the sustainable literature  
and make comment about it.

SEMINAR TASKS: Each week I will introduce you to a single piece  
of sustainable literature, whose topic (hopefully) breaches all  
subject areas offered in this program. This article will point  
you collectively in a direction of independent reading for the  
following week. You will be expected "to follow up" on this  
initial piece of literature with the intent to:

- 1) get your hands on everything written about this theme
- 2) compare and contrast the ideas conveyed in this larger  
literature with the ideas contained in this common reading
- 3) make judgmental decisions about the intellectual content  
of all materials read, and
- 4) write it all up in as many pages as needed. This written  
synthesis of what you have read and your feelings toward it  
will include your best writing form. It shall include  
introduction, body, conclusion and bibliography in the style  
of the American Psychological Association
- 5) verbal assignment from the required text, by Piasecki,  
will be given as needed

A discussion of your statement, and all others, will rivet our  
attention for an hour or so. Your written statement will be  
handed in after class.

SEMINAR EVALUATION: Expect to be graded generally on 1) your ability  
to complete the written task set before you, and 2) your willing-  
ness to share your views on this task in class. Specific evalua-  
tion will cover 1) your writing style as it improves over the  
course of the semester, to include an expressed ability to be  
brief, concise, and clear in your judgments, and 2) continuity  
of writing style.

SEMINAR TOPICS: Week 22 What is this thing you do, Sustainable Systems?  
29 What do you say to technology?  
5 Are sustainable systematists racist?  
12 How radical are you?  
14 (Text exercise)  
20 For which future climate do we, today, design?  
March 50 World population growth  
120 World population growth  
190  
April 21 (Text exercise)  
23  
161 Will socio-economic injustices be eliminated  
in a sustainable society?  
231 How spiritual must sustainable systematists be?  
301 (Text exercise)  
16 What is this thing you do, Sustainable Systems?

Our one-hour seminar provides us the single weekly opportunity to interact as an MS3 student body. Lacking coffee pot and couches, around which most graduate programs revolve, we are left with this moment of space when we might commune with one another, share information regarding sustainability, and mutually expose to one another our highly subjective insights into this thing we do. Here's your chance to air all.

Our seminar shall derive some minimal structure from use of two thin texts, Green Business: Hope or Hoax (1991) and Turtle Talk: Voices for a Sustainable Future (1990), both edited by Christopher and Judith Plant as part of the New Catalyst Bioregional Series from British Columbia. Further structure shall be given by each of you in your own time as you lead the class through perhaps ~~25-30~~<sup>15</sup> pages of these texts. This leadership role shall cast you as text editor. You will fill in all details of context needed to appreciate fully the pages assigned. Sign up is as follows:

Sept	11	<u>Green Business</u> , pp.	1-18	<u>Joy Jenkins</u>
	18		19-34	<u>Tatiana</u>
	25		35-51	<u>John M. ...</u>
Oct	2		52-78	
	9		79-101	<u>Mac McClure</u>
	16		102-119	<u>hinda</u>
	23		120-136	<u>Mark Sweeney</u>
	30	<u>Turtle Talk</u>	2-21	<u>Vang Wie</u>
Nov	6		22-39	<u>Michael A. Crews</u>
	13		40-67	<u>Stephen Fones-Figge</u>
	20		68-93	<u>Deborah Vane-Pore</u>
	27		94-113	
Dec	4		114-133	
	11	Catch Up Day		

Slippery Rock University  
Department of Parks and Recreation/  
Environmental Education

Sustainable Systems Seminar  
71-740 Spring 1992  
Instructor: Patrick

### COURSE SYLLABUS

Seminar Theme: Grant writing

Seminar Purpose: to write collectively a competitive grant proposal to the Pennsylvania Hardwood Council.

Seminar Goals: 1) to foster a sense of MS3 community  
2) to acquire grant writing skills  
3) to enhance workshop/project efforts at Harmony Homestead  
4) to demonstrate the bioregional concept of local production/local consumption

Seminar Format: meet weekly during scheduled time to share grant progress; devote 2-3 hours per week on out-of-class preparation of grant input.

Required Text: Locke, Spirduso & Silverman (2nd ed.). 1987.  
Proposals That Work: A Guide for Planning  
Dissertations and Grants. Sage Publications,  
Newbury Park.

Grading Procedure: each seminar student will be peer-graded by criterion of grant participation.

1. Course Title and Number THE QUEST FOR PERMACULTURE: PREE 716462. Semester Hours 3

11. Through this course students discover their abilities to blend a secular world view of permaculture landscape with a sense of place sacredness. Course content and activities bring MS3 students into contact with the range of historical and contemporary processes needed to design within the local bioregion. A series of field trips into this bioregion is made to observe the more sustaining of these processes.

Prerequisites: none

12. The "sister course" to this new course is PREE 71641, Principles and Techniques of Permaculture Design. By intent, secular issues of permaculture predominate. For example, hands-on training is given on site mapping, surveying, gardening and water management. All instruction is given at the Harmony House demonstration site. This new course complements PREE 71641 in two substantial ways. (1) Scale complementarity. PREE 71646 places permaculture and its larger context of sustainability within the framework of Western Pennsylvania's bioregion. The working axiom is that permaculture design of one's property (e.g., Harmony Homestead) cannot be complete without a sense of the historical and cultural processes on-going with the surrounding bioregion. Using contemporary scientific vernacular, "the micro- (the permaculture design site) must contain the macro- (the bioregion surrounding the design site)." 2) Complementarity of subject matter. This new course, when taught in tandem with PREE 71641, brings permaculture at SRU to the cutting edge of the larger, world-wide permaculture movement. The earlier works in permaculture focused principally on pre-existing categories of site design: climate, vegetation, water, soils and earth resources (Mollison, A Practical Guide for a Sustainable Future, passim). Today, themes of transformational development, grassroots organizational skills, community revitalization, and empowerment are being added to the permaculture design process (see, for example, The Permaculture Activist, VIII, No. 2, Aug., 1992, passim). These latter themes of permaculture and sustainability convey more of a sense of the sacred. This new course, then, gives the MS3 program's permaculture thrust its broadest of design contexts. Sensitivity of observation and listening skills as developed in this new course shall equip the trained permaculture designer to exercise her and his site knowledge in expanded and more effective ways. Taken together, PREE 71641 and PREE 71646 establish the proper foundation for assessing and acting on permaculture design problems.

13. Objectives

- A. To develop sensitivity to micro-environments and especially to their dynamic and changing nature.
- B. To identify and bond with sacred places within the Western Pennsylvania bioregion.
- C. To become familiar with emergent movements for sustainability in the Pittsburgh metropolitan region and hinterland.

Competencies

- A. To be able to construct/reconstruct a coherent multi-dimensional picture of the species occupancy in Western Pennsylvania.
- B. To develop interviewing and directed listening skills and to understand the cycling of information as a prerequisite for establishing effective networks of social and cultural action.



- C. To learn to read cultural landmarks, to interpret the meaning of pioneer and select vegetation, and to identify wild and escaped domestic edible plants
  - D. To design holistically
14. Participation in class discussions related to assignments given - 20%
- Two technical reports, each pertaining to a facet of the more sustaining features of the Western Pa. bioregion - 20%
- One research project, directed at technique and design strategies needed to enhance the sustainability of the Western Pa. bioregion - 30%
- One comprehensive, final examination - 30%
15. Instructor lecturing, as needed
- Laboratory: a series of field trips to selected rural and urban sites within the local bioregion
- In-class group assignments, due regularly throughout the semester, each focused on the required technical reports and research projects
- In-class group discussions of assigned reading materials

## A QUEST FOR PERMACULTURE

### Course Outline

- I. Secularity and Sacredness: The Metaphysics of Permaculture
  - A. Cosmologies of the Sacred: The role of indigenous belief systems in permacultural sustainability
  - B. Indigenous peoples of the W. Pa. bioregion: living traditions and archaeology as related to permaculture design
  - C. Occupancy of the W. Pa. bioregion and its impact on sustainability
  - D. Climate, geology and landforms of Western Pa.: secular knowledge needed to design within the local bioregion
  - E. Chaos theory, sustainability and permaculture design
- II. Permaculture Design Skills: Reading the Landscape
  - A. Permaculture as the promotion of forest cover: stages of plant succession: palimpsests, weeds, pioneer species and climax
  - B. Wild edibles, escaped domesticates and exotics: their reintroduction via the permaculture design process
  - C. Vegetation and soils of W. Pa.: secular knowledge needed to design with the local bioregion
  - D. Phenology and its contribution to the permaculture design process
- III. Linking the Permaculture Client to Bioregional Information Cycles
  - A. Reevaluating cultural knowledge: honoring the other; everything is a resource
  - B. Local history and the design process: oral traditions, historic weather, folk architecture, past commerce, ritual
  - C. Alternative sources of knowledge and their use in the permaculture design process: animal breeders, fruit explorers, merchants, travellers
  - D. Methods available to link client to the bioregion: stimulus and response, interviewing, directed listening, the right-brain client
- IV. Permaculture Process within the W. Pennsylvania Bioregion
  - A. Flow: water, wind, materials, people, ideas
  - B. Mosaics of community permaculture in W. Pa.: villages, suburbs, neighborhood associations, ethnic identities
  - C. Resource sheds of the city
  - D. Persistence of natural patterns within the built environments of W. Pa.: wildlife corridors, greenbelts, city/country interdigitation
- V. Permacultural Sustainability as Empowerment: Autopoeisis
  - A. Community-based food production: gardening, gleaning, wild harvesting
  - B. City farms, city as farm, urban/rural links
  - C. Community redesign opportunities
  - D. The permaculturist as activist
  - E. Empowering landscapes via permaculture design: land restoration and the enhancement of sacred values

Slippery Rock University

P.R.E.E. - MS3 curriculum

**The Quest for Permaculture (3hr. course)**

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PSE 445

Agricultural Ecology

Fall 1993

Instructors: Matt Liebman (418 Deering Hall, 581-2926)  
Stewart Smith (307 Winslow Hall, 581-3174)

PSE 445, Agricultural Ecology, is intended for upper level undergraduate and graduate students interested in technical, social, economic, and ethical components of sustainable farming systems. Students taking the course should have completed PSE 105, Principles and Practices of Sustainable Agriculture, or its equivalent.

PSE 445 is a reading and writing intensive course. Students will be expected to write and, following a critique by the instructors, rewrite a 10-12 page essay concerning the structure and function of a farm we will visit as a class. The essay must be typed. It will be graded on style (grammar, spelling, organization) as well as content. The essay will be due by the start of class on 26 October. Rewritten versions are due one week after original versions are returned to you. Late papers will not be accepted, except in cases of medical or family emergencies. There will be four presentations by guest speakers and one field trip (see syllabus). Date, time, and destination of the field trip will be announced during the first week of class. The trip involves a visit to a local farm and is a critical element of the first writing assignment. Students who anticipate problems in participating in the trip should speak with the instructor as soon as possible.

Texts for the course are available at the campus bookstore. We will use Marty Strange's book, *Family Farming: A New Economic Vision*, and a reader of various journal articles. Students are responsible for completing reading assignments as the course proceeds. Students should be prepared to be called upon to discuss reading materials during class sessions.

There will be a take-home final exam but no hour exams during the semester. Grades will be based on the essay (30%), the final exam (60%), and an evaluation of in-class performance (10%).

PSE 445

Agricultural Ecology

Fall 1993

Instructors: Matt Liebman & Stewart Smith

### Schedule and Reading Assignments

#### Module 1: Agroecosystem Analysis and Design

**Tu Sept 7** Introduction

**Th Sept 9** Agroecosystem Analysis, Rapid Rural Appraisal

Conway, G. R. and E. B. Barbier. 1990. After the Green Revolution: Sustainable Agriculture for Development. Earthscan Publications, Ltd., London. Chap. 2: Indicators of agricultural performance; Appendix: Agroecosystem analysis.

Lowrance, R., P. F. Hendrix, and Eugene P. Odum. 1986. A hierarchical approach to sustainable agriculture. American Journal of Alternative Agriculture 1: 169-173.

**Tu Sept 14** Agroecosystem Analysis, Rapid Rural Appraisal

Oberle, S. L. and D. R. Keeney. 1991. A case for agricultural systems research. Journal of Environmental Quality 20(1): 4-7.

Crews, T. E., C. L. Mohler, and A. G. Power. 1991. Energetics and ecosystem integrity: the defining principles of sustainable agriculture. American Journal of Alternative Agriculture 6(3): 146-149.

**Th Sept 16** Agroecosystem Analysis and Design

Mountjoy, D. C. and S. R. Gliessman. 1988. Traditional management of a hillside agroecosystem in Tlaxcala, Mexico: an ecologically based maintenance system. American Journal of Alternative Agriculture 3: 3-10.

Crews, T. E. and S. R. Gliessman. 1991. Raised field agriculture in Tlaxcala, Mexico: an ecosystem perspective on maintenance of soil fertility. American Journal of Alternative Agriculture 6(1): 9-16.

**Tu Sept 21** Agroecosystem Analysis and Design

Kaffka, S. R. 1985. Thirty years of energy use, nutrient cycling and yield on a self-reliant dairy farm. Pp. 143-158 in: T. C. Edens, C. Fridgen, and S. L. Battenfield (eds.), Sustainable Agriculture and Integrated Farming Systems. Michigan State University Press, East Lansing.



**Th Sept 23      The Social Context of Agroecosystems**

Loomis, R. S. 1984. Traditional agriculture in America. *Annual Review of Ecology and Systematics* 15: 449-478.

**Tu Sept 28      Discussion**

**Th Sept 30      Guest Lectures**

Dr. Deborah Stinner, Ohio State University  
"Ecological Insights from Amish Farming Systems"

Dr. Ben Stinner, Ohio State University  
"On-Farm Research"

**Module 2: Generating and Exchanging Information and Technology**

**Tu Oct 5          On-Farm vs. On-Station Research**

Lockeretz, W. 1987. Establishing the proper role for on-farm research. *American Journal of Alternative Agriculture* 2: 132-136.

Thompson, R. and S. Thompson. 1990. The on-farm research program of Practical Farmers of Iowa. *American Journal of Alternative Agriculture* 5: 163-167.

**Th Oct 7          Participatory Research**

Chambers, R. 1990. Farmer first: a practical paradigm for the third agriculture. Pp. 237-244 in: M. A. Altieri and S. B. Hecht (eds.), *Agroecology and Small Farm Development*. CRC Press, Boca Raton, FL.

Ashby, J. A. 1990. Small farmers' participation in the design of technologies. Pp. 245-253 in: M. A. Altieri and S. B. Hecht (eds.), *Agroecology and Small Farm Development*. CRC Press, Boca Raton, FL.

**Tu Oct 12        Agricultural Technology and Development**

Wright, A. 1984. Innocents abroad: American agricultural research in Mexico. Pp. 135-151 in: W. Jackson, W. Berry, and B. Colman (eds.), *Meeting the Expectations of the Land*. North Point Press, San Francisco.

Rhoades, R. E. 1984. *Tecnicista versus campesinista: praxis and theory of farmer involvement in agricultural research*. Pp. 139-150 in: P. Matlon, R. Cantrell, D. King, and M. Benoit-Cattin (eds.), *Coming Full Circle*. International Development Research Centre, Ottawa, Canada.

**Th Oct 14**      **Indigenous Knowledge and Agricultural Development**

Bentley, J. W. 1989. What farmers don't know can't help them: strengths and weaknesses of indigenous technical knowledge in Honduras. *Agriculture and Human Values* 6(3): 25-31.

**Tu Oct 19**      **Discussion: Field Trip Report**

**Th Oct 21**      **Discussion: Field Trip Report**

**Tu Oct 26**      **Discussion/Essay Due**

**Module 3: Diversity and Agroecosystem Function**

**Th Oct 28**      **Biodiversity in Agroecosystems, Crop Genetic Diversity**

Paoletti, M. G., D. Pimentel, B. R. Stinner, and D. Stinner. 1992. Agroecosystem biodiversity: matching production and conservation biology. *Agriculture, Ecosystems and Environment* 40: 3-23.

Clawson, D. L. 1985. Harvest security and intraspecific diversity in traditional tropical agriculture. *Economic Botany* 39: 56-67.

Brush, S. B. 1991. A farmer-based approach to conserving crop germplasm. *Economic Botany* 45(2): 153-165.

**Tu Nov 2**      **Cover Crops and Hedgerows**

Sarrantonio, M. 1992. Opportunities and challenges for the inclusion of soil improving crops in vegetable production systems. *Hortscience* 27(7): 754-758.

Shennon, C. 1992. Cover crops, nitrogen cycling, and soil properties in semi-irrigated vegetable production systems. *Hortscience* 27(7): 749-754.

Ofori, F. and W. R. Stern. 1987. Cereal-legume intercropping systems. *Advances in Agronomy* 41: 41-90.

Bugg, R. L., M. Sarrantonio, J. D. Dutcher, and S. C. Phatak. 1991. Understory cover crops in pecan orchards: possible management strategies. *American Journal of Alternative Agriculture* 6(2): 50-62.

Kort, J. 1988. Benefits of windbreaks to field and forage crops. *Agriculture, Ecosystems and Environment* 22/23: 165-190.

Baldwin, C. S. 1988. The influence of field windbreaks on vegetable and specialty crops. *Agriculture, Ecosystems and Environment* 22/23: 191-203.

Th Nov 4      Green Manuring and Crop Rotation

- Auld, D. L., B. L. Bettis, M. J. Dial, and G. A. Murray. 1982. Austrian winter and spring peas as green manure crops in northern Idaho. *Agronomy Journal* 74: 1047-1050.
- Crookston, R.K., J.E. Kurle, P. J. Copeland, J. H. Ford, and W. E. Lueschen. 1991. Rotational cropping sequence affects yield of corn and soybean. *Agronomy Journal* 83: 108-113.
- Johnson, N. C., P. J. Copeland, R. K. Crookston, and F. L. Pfeleger. 1992. Mycorrhizae: possible explanation for yield decline with continuous corn and soybean. *Agronomy Journal* 84: 387-390.
- Fox, R. H. and W. P. Piekielek. 1988. Fertilizer N equivalence of alfalfa, birdsfoot trefoil, and red clover for succeeding corn crops. *Journal of Production Agriculture* 1(4): 313-317.

**Tu Nov 9**      **Vegetation Diversity and Insect Pest Management**

- Andow, D. A. 1991. Control of arthropods using crop diversity. Pp. 257-284 in: D. Pimentel (ed.), CRC Handbook of Pest Management in Agriculture, Vol. 1. CRC Press, Boca Raton, FL.
- Grossman, J. and W. Quarles. 1993. Strip intercropping for biological control. IPM Practitioner 15(4): 1-11.

**Th Nov 11      Vegetation Diversity, Weed and Pathogen Management**

- Liebman, M. and E. Dyck. 1993. Crop rotation and intercropping strategies for weed management. *Ecological Applications* 3: 92-122.
- Marshall, D. 1991. Crop diversity for plant pathogen control. Pp. 569-577 in: D. Pimentel (ed.), *CRC Handbook of Pest Management in Agriculture*, 2nd edition, Vol. 1. CRC Press, Boca Raton, FL.
- Wolfe, M. S. and J. A. Barrett. 1980. Can we lead the pathogen astray? *Plant Disease* 64(2): 148-155.

**Tu Nov 16**      Guest Lecture

Dr. Alison Power, Cornell University  
"Ecological Approaches for Insect Pest Management"

Williams, P. A. and A. M. Gordon. 1992. The potential of intercropping as an alternative land use system in temperate North America. *Agroforestry Systems* 19: 253-263.

Zhang, A. and W. Olkowski. 1992. Agroforestry and IPM in China. *IPM Practitioner* 14(4): 1-12.

King, S. and W. Olkowski. 1991. Farmscaping and IPM. *IPM Practitioner* 13(10): 1-12.

**Th Nov 18**      Agroforestry

Rocheleau, D. F. Weber, and A. Field-Juma. 1988. Agroforestry in Dryland Africa. International Council for Research in Agroforestry, Nairobi, Kenya. Chap. 4: Agroforestry in cropland.

**Tu Nov 23**      Discussion

**Th Nov 25**      Thanksgiving holiday

Module 4: *Agriculture and Human Values*

**Tu Nov 30**      Guest Lecture

Dr. Frederick Kirschenmann, Kirschenmann Farms,  
Windsor, ND  
"Agriculture, Human Values, and Social Structure"

Berry, W. 1977. *The Unsettling of America*. Avon Books, New York. Chap. 4: The agricultural crisis as a crisis of culture.

Allen, P., D. Van Dusen, J. Lundy, and S. Gliessman. 1991. Integrating social, environmental, and economic issues in sustainable agriculture. *American Journal of Alternative Agriculture* 6(1): 34-39.

**Th Dec 2            The Industrialization of Agriculture**

Urban, T. N. 1991. Agricultural industrialization: it's inevitable. *Choices* 9(4): 4-6.

Hoag, D. L. and E. C. Pasour Jr. 1992. It's a dilemma. *Choices* 10(1): 32-34.

Smith, S. 1992. Is there farming in agriculture's future? The impact of biotechnology. Presentation to the College of Agriculture and Life Sciences, Univ. of Vermont, Burlington.

**Tu Dec 7            Agricultural Policy and Sustainability**

Faeth, P. 1993. Evaluating agricultural policy and the sustainability of production systems: an economic framework. *Journal of Soil and Water Conservation* 48(2): 94-99.

Goldstein, W. A. and D. L. Young. 1987. An agronomic and economic comparison of a conventional and a low-input cropping system in the Palouse. *American Journal of Alternative Agriculture* 2: 51-56.

**Th Dec 9            Socioeconomic Aspects of Sustainable Agriculture**

Strange, M. 1989. *Family Farming: A New Economic Vision*. University of Nebraska Press, Lincoln. Pp. 8-11, 39-42, 52-55, 78-103.

**Tu Dec 14          Socioeconomic Aspects of Sustainable Agriculture**

Strange, M. 1989. *Family Farming: A New Economic Vision*. University of Nebraska Press, Lincoln. Pp. 113-121, 166-237.

**Th Dec 16          Discussion**

# **NATIONAL CURRICULUM FOR SUSTAINABLE AGRICULTURE**

**Developed by:  
SARE Working Group, Lincoln, NE  
April 12-13, 1993**

**Audience:** Educators interested in sustainable agriculture

**Objective:** To review ideas related to sustainable  
agricultural education

To suggest educational strategies and major  
knowledge gaps

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**NATIONAL CURRICULUM FOR SUSTAINABLE AGRICULTURE**  
Workshop Notes from April 12-13, 1993, Lincoln, NE

**Potential Audiences:**

- \* Elementary students
- \* Middle School students
- \* High School students
- \* College students (undergraduate)
- \* Graduate Students
- \* Young Farmer groups
- \* Beginning Farmers
- \* Owner-operator Family Farmers
- \* Fertilizer/Chemical Dealers and Employees
- \* Fertilizer/Chemical Industry Technical Reps
- \* Crop Consultants
- \* Agricultural Lenders
- \* Absentee Land Owners
  - \* Owner/Tenant relationships
  - \* Lease to Buy Arrangements
  - \* Sale Arrangements (eg. Land-Link Realty)
  - \* Donations to Church Organizations
  - \* Donations/Sale to Land Trusts or Public Ownership
- \* SCS, ASCS, EPA, other government Employees
- \* Extension Agents, Specialists
- \* Faculty of Colleges of Agriculture
- \* Public Research Community (Universities, ARS/USDA)
- \* Private Industry Research Specialists
- \* Environmental Advocates and Groups
- \* Consumers and Advocacy Groups

**Fred Kirschenmann's Presentation: "Rethinking Economics"**

- \* primary reference: Cobb and Daly: For the Common Good  
  
audience is policy makers, and ultimately farmers; need to distinguish between development and growth; profitability has traditionally meant adding monetary value to owner's assets
- 1. whole farm systems need to be considered in terms of decades long periods of time (versus single enterprise profit or loss within a growing season)
- 2. diversification is the key to spread risk, spread market and weather effects (versus specialization and high risk)

3. cycling of resources, especially on-farm resources, such as animal waste into nutrients (versus input/output linear approach that depends on continuous infusion of off-farm inputs)
4. **value-retained economics**, eg. Steward Smith of GPO, Is there farming in our future? and more recent book; how do we retain value in our farming sector?

marketing share	1910 = 44%	1990 = 67%
input share	1910 = 12%	1990 = 24%
farmer share	1910 = 41%	1990 = 9%

(other reference: Lois Hudson, The Bones of Plenty)

5. redefining economic efficiencies
  - \* secondary factors
  - \* production efficiencies (greater production efficiency will not benefit either farmer or consumer, since they only account for 10% of income share right now; eg. increase efficiency by 10% will only benefit consumer by 1% and farmer by 0.1%)
6. calculating the ecological and social costs/benefits of farming: paying the farm bill, importance of farmers to society, animal welfare issues, government program stability eg. National Geographic Soc: The Costs of Technology (film)
7. rural community dimensions
8. other bottom lines -- eg. sustainable development, quality of life

#### Key elements from discussion on April 13 (Tuesday)

- \* we need a solid data base from which to operate, to convince both farmers and institutions to change
- \* some argue that there is a solid data base now that was not apparent a decade ago: new research results, much on-farm data and experience, "rediscovery of old literature" on integrative systems
- \* recognize that we need well identified frames of reference with which to compare results, objectives
- \* Extension needs to redefine problems, focus on key issues, recognize that there are "declining communities" rather than just "changing communities"
- \* need to seek methods to reach extension agents, specialists, administrators within their predominant reward system
- \* PFI provides a workable and successful model, with local chapters, teamwork, tie-in with extension at ISU, bridges to local business and industry, tours, field days, reports of results from on-farm tests, economics of practices



- \* recognize that there is an artistic dimension to implementation of practices and especially design of systems
- \* need to focus on demand -- most farmers are still tied closely to ASCS, and that is where they are coming from when we consider change
- \* with enough study and publicity, policy will shift in response to demand, to a wider appreciation of complex challenges, although this will not happen quickly or easily
- \* policy makers are a key audience, since they are focal points in change in farm programs; need models of success, data base from which to calculate and demonstrate practical economics of practices and systems, responses to changes in policy

#### Key Resources for Farmers, Researchers, Extension People, Policy Makers

- \* information that is going to be published for general use:
  - \* need to secure copyrights when needed
  - \* materials need to be well indexed and cross referenced
  - \* need to find most appropriate place to store & retrieve
- \* other farmers, professional colleagues, traditional farmers, older conventional farmers with long-term experience
- \* technical guides, government information, bulletins
- \* specialized abstract services, eg. Rodale Seive (targeted information resource)
- \* reading, telephone contacts, talks with tenants/owners
- \* landgrant scientists, extension specialists, SCS for technical compliance with regulations
- \* implement manufacturers, industry dealers in fertilizers and pesticides
- \* conservation district specialists
- \* older literature, yearbooks of agriculture such as '37 and '38, older Ag Exper. Station bulletins and reports
- \* current farm magazines: The New Farm, Farm Journal, Soybean Digest, J. Soil & Water Conservation, J. Production Agr., J. Sustain. Agr., Amer. J. Alternative Agr., Successful Farming, HortIdeas (Gravel Switch, KY), Furrow Magazine, Stockman & Grass Farmer, Organic Farmer, PFI & CRA and many other newsletters, Mother Earth News (older copies)
- \* write to authors of individual articles for details and questions about specific practices and applications
- \* researchers tap farmers and extension specialists/agents for ideas, plus all the above sources; other researchers in informal contacts
- \* SAN wants to capture experiential information, provide some type of credibility screen, and make info available; similar to current farmer-to-farmer networks
- \* ATTRA fills specific requests for info, references, customized responses to questions from growers, research & extension
- \* NAL has just put earliest 20 years of Agronomy Journal now into AGRICOLA with titles, keywords and abstracts; routine data base goes back only to 1979

- \* older handbooks, bulletins on key topics now have been put into a special bibliography available only in hard copy
- \* indigenous science is being captured from farmers for use by researchers, extensionists, industry, other farmers
- \* Future Survey, Futures Magazine, Futures Journal, Technological Forecasting, Coevolution Quarterly, NPR
- \* Data Transmission Network (DTN), market news, weather news, predictions, key news items from international services and U.S. policy centers, major grain agreements
- \* newsletters of many types soon to be replaced by electronic resources that are cheaper, easy to search, more comprehensive

### Major Gaps in the Information System and Knowledge Base

- \* one key need is an annotated bibliography of our information from the workshops, from previous module development, and from all other available sources -- this would prove invaluable, since there is currently not a resource that tracks and summarizes educational materials
- \* several farmers argued that there is plenty of information if it could be located; this was not the case a decade ago
- \* low-input livestock systems, including how to increase gross productivity, use CRP ground creatively and profitably, integrate crop and livestock components
- \* ethics and spirituality need to be included, also answer "why sustainable agriculture" to mainstream audiences:
  - \* Wendell Berry -- several books with spiritual dimension
  - \* Thomas Berry -- Dream of the Earth, The Universe Story
- \* better availability of farm program information, especially new options such as the Integrated Farm Management Program
- \* how do we reduce tillage, fertilizers, pesticides, while understanding the role of rotations, nutrient cycling, pest populations, competition for resources, complementarity
- \* how does the right information get into the right hands, and how/why do people change: government programs, fear, peer pressure, incentives, profit, environmental benefits for family and/or community
- \* lack of site-specific information, and no rational method of generating that information; what is needed is an efficient process for farmers to develop their own site-specific info, as well as a mechanism to characterize their sites and make this info available to others
- \* marketing alternatives = = > leads to an alternative food system
- \* technology exchange will replace the concept of technology transfer, the classical extension/SCS approach
- \* methods are needed to deal with short-term land tenancy challenges; those who invest in soil conservation and conservation approaches need to realize some benefit from those activities -- not just have a long-term benefit accrue to the land owner

- \* rational equipment choices, size of individual machines, time needed, trade-offs between timeliness and total investment
- \* need to get past the moral condemnation dimension of any change from the current methods or status quo to a new paradigm and its implementation; any community of scientist builds on past work, and we need to recognize and applaud those efforts, even as we work toward alternatives; there is never a basis for condemning past work, and we learn from our mistakes over time -- their very inception and testing is what makes the system move ahead; all advances are based on other practices that went before, but that are shown now to be sub-optimum
- \* institutions should legitimize and help farmers and other groups to seek their own answers, do research
- \* currently, most experiment stations verify what the best farmers have been doing for some time, rather than moving ahead of the curve -- making mistakes, learning about new options
- \* structure of institutions needs to be revised: how do we creatively downsize? Most administrators currently subscribe to some degree to the concept of sustainability, but find it difficult to help the transition along
- \* market gardening, suscription farming, community supported agriculture should be a part of our extension/research agenda
- \* there is an "arts component" to what we do -- how do we creatively incorporate art, music, photography, drama into our educational agenda?
- \* restauranteurs are another audience: Alice Waters' "Chez Panis" in Berkeley is an example of success in a specialty market; can we get people to ask the question, "where does my food come from?" "who is my farmer?" "whose food shall we eat?" urban consumer linkages needed
- \* can we take creative approaches to building/saving communities; eg. Matfield Green model pursued by Wes Jackson
- \* farm policy needs to be explored: what is an ideal policy: who can make proposals to change the policy?
- \* rural repopulation is an agenda for the MN or WI department of agriculture; should this not be a general theme for all of extension?
- \* even though we work heavily on component practices, we need a valid economic evaluation of the use of each practice as a component of a larger system
- \* landgrant administrative support is critical; this goes far beyond just the extension, research, and teaching leadership of the colleges
- \* observational skills are important: how do we look at things and figure out what is going on? the Native American perspective is important: look at what is here as the result of seven generations and activities, and make current decisions based on the expected impact for seven generations into the future
- \* Native American skill and outlook, including inherent wisdom has somehow been lost; some is captured in books, eg. Bison Books of Nebraska Press
- \* at university level, we need to produce salable students, perhaps through intern programs, practical summer experience, eg. crop scouting

- \* need to prepare students with the skills needed in agribusiness; how do we reach out in new ways to industry? How do we get them involved where appropriate in the educational process?
- \* there is much folklore attached to agriculture; this is of interest to some, and could prove valuable in some ways
- \* how can we bridge the gap with the environmental community? How do we communicate with the various factions within this community; people on the land have different agendas at times, but sometimes the same; Audubon and Center for Resource Economics seem to think that regulation is the route to all solutions; other groups are more reasonable -- most of about 60 other groups are very interested in sustainable agriculture, small farm issues, and are working to make this happen as part of their agenda
- \* regulations in agriculture do cause some real change: erosion control through terraces, pesticide applicator certification every three years captures a wide audience that otherwise would not come near extension meetings
- \* there is need for a vision of where we want to be in 100 years, eg. design agriculture to meet dietary needs, people's priorities
- \* farmers can farm ecologically; customers do want organically grown produce, but we lack the infrastructure to handle this profitably and efficiently on a very large scale so far
- \* educational and informational gaps in the system are often confused or confounded with other gaps -- policy, demand, market structure, other
- \* integrated resource management systems, whole farm planning systems will no doubt replace piecemeal and single practice programs and requirements
- \* we need methods to conduct need studies, impact studies, design evaluations for alternative systems and efficient resource use
- \* what are the criteria for sustainability? NCR-157 is working on a list; there is an article from 1989 California Farmer that has a useful list
- \* we need planning for a desirable future, not just a predictable one; if we work toward what is predictable, that is what we will get
- \* can we develop a methodology to study systems? Is there tenure potential in the study of systems? How do we achieve replication in time and space, or do we need this? Can we build valid models, expert systems? Are these useful?
- \* there is a vital need for new learning configurations, for experiential learning, to get past the myth that all/most learning occurs in the classroom: Paolo Freire ideas on experiential learning, Ivan Illich ideas in book, Deschooling Society, David Norman's writing on FSRE



# **RESHAPING UNDERGRADUATE AND GRADUATE EDUCATION TO INCLUDE A WHOLE SYSTEMS EMPHASIS**

Developed by:  
Charles Francis, Nancy Grudens Schuck,  
and Lisa Huyck

**Audience:** Educators in Higher Education

**Objective:** To identify key issues related to sustainable  
agricultural

To describe these issues

To develop educational recommendations to  
address these issues further

## **RESHAPING UNDERGRADUATE AND GRADUATE EDUCATION TO INCLUDE A WHOLE SYSTEMS EMPHASIS**

### **SUMMARY**

#### **Charge to the Group:**

- \* What is the scope, and what are the key issues?
- \* How are the key concerns being addressed presently?
- \* What are recommendations for addressing them further?
- \* What are logical steps regarding institutional barriers and pursuing opportunities

#### **Student Views:**

With active participation from students as well as faculty, staff, extension specialists, and non-profit group representatives, discussion began with a consideration of the range of satisfaction regarding integrative education in agriculture. The consensus was that students want integrative, systems-oriented sustainable agricultural education; others want to provide this for students. From the students' point of view, there appears to be a range of activities in our current programs from "unsatisfying" to "moderately good"; none was identified as meeting all the needs:

#### **"Very Limited/Unsatisfying Program"**

- \* no integrated course work
- \* no encouragement/opportunities to be exposed to political, social, public views
- \* however, applied work with connections to farm situations generally present

#### **"Moderately Good Program"**

- \* integrated major or project permitted
- \* usually required large grad committee, sometimes hard to meet, can be an obstacle
- \* might be additive activity among disciplines, but not really integrative
- \* funding for related research and projects harder to secure than narrow projects
- \* students accused of being generalists, not a complimentary term in departments

#### **"Very Good Programs"**

- \* none reported in the U.S. context

### Comments on Institutions

Faculty, extension, university staff, and other educators relayed divergent views of strategies to create more integrative sustainable agriculture education. Several offered specific suggestions for modifying existing programs and curricula toward this goal. Others asserted that only a "break-with-the-old" and creation of new, purposefully designed programs and institutions would result in real change.

### Needed Modifications:

There were suggestions that it would be valuable to require courses in these areas:

- \* history of science
- \* systems science
- \* meta learning (learning how to learn)
- \* critical thinking capacity building activities

The group suggested that a number of opportunities already exist for undergraduate students to become involved with real-world, whole farm systems via:

- \* whole farm case studies for classroom study
- \* internships during summers or other breaks
- \* projects, sometimes as groups
- \* courses that include a variety of views, eg. smorgasbord "survey" courses

### Giving Humpty Dumpty a Push

Some suggested a break from institutions or programs to form new structures, or applying extraordinary reform to existing programs/institutions/curricula. Small modifications were discussed as ultimately unsatisfying; a better use of resources and time is to start programs anew. This was also seen as a painful path. Sufficient discussion of what distinguished a "break from tradition" from a "modification of current programs" did not occur, although one example from Florida of creating the new College of Natural Resources was seen as a landmark model to be observed.

### Recommendations and Opportunities:

#### 1) **Top-Down Reshaping of Programs**

There was discussion about the potential effectiveness of change initiated by the administration versus that initiated by faculty or students. Examples of each are available to study, and each has peculiar advantages and disadvantages. When change is mandated by the administration, it causes certain systemic things to happen: people are identified with new areas, budgets are allocated according to different criteria. Faculty usually have a "buy-in" to the new program that is directly related to their involvement in the process of designing that change.



University of Missouri - Columbia: The university recently organized their faculty in agriculture around several areas or units. The conventional departments have generally maintained their disciplinary identity within these units. It has been observed so far that faculty identity is still around their professional area and peers within the traditional discipline; journals, professional meetings, physical locations on campus, major research projects, specific topic academic courses, peer support, and narrow constituencies outside the university all reinforce the classical department lines. Faculty in Missouri would consider the reorganization a very qualified success at best, and some suggest that this has only added one more layer of administration.

University of Florida: The university recently named a new Dean of the College of Natural Resources, but did not assign any faculty to that college. It was left to faculty to voluntarily affiliate with the new college, forming interest groups or educational task forces around several topics. Although the model is new, it has generated much interest on campus. There are many details to be resolved on budgets, faculty evaluation and tenure, lines of reporting and responsibility. It will take time to evaluate the benefits of this model.

## **2) Bottom-Up Reshaping of Programs**

Bottom-up reshaping can be illustrated by the many courses and some curricula emerging on sustainable agriculture and systems. These courses have different levels of administrative support, but in general have attracted much student interest.

University of Maine: There is an established undergraduate and graduate program in sustainable agriculture. There are about 30 faculty members from numerous departments affiliated with the program, and many co-advise students in multidisciplinary graduate thesis projects. The program has attracted many top students to date.

University of California at Davis: There is a multidisciplinary masters degree in international agriculture that includes some systems work. This program allows students to build a relevant course program that includes key basic courses and integrative systems courses from a number of participating departments. The faculty represents all these conventional departments, and oversees the requirements for the major.

North Central Institute for Sustainable Systems: This organization is still in the planning stage, and will launch an undergraduate major in "sustainable systems," using key faculty members from the 12 universities in the region plus qualified farmers, specialists from industry and the non-profit organizations. In addition to basic courses in sciences and humanities, students will have one course

or seminar each semester in sustainable systems. One year will be devoted entirely to special systems modules and to experiential learning on farms and in communities, culminating in a senior thesis or comparable project over their on-farm research community surveys, or other relevant activities.

### 3) **Joint Initiation of Programs**

A joint activity initiated by administrators and faculty that includes both top-down and bottom-up activities is perhaps the best available model.

Hawkesbury College of University of New South Wales: This program represented a complete restructuring of the educational agenda and program. Students now are focused on real world problem identification and solution building, working as teams on farms to appreciate the structure and integrative activities on each operation. Teams work together to analyze practices and enterprises, and present alternatives to farm owners. They present these ideas back to the farmers and are evaluated by faculty and the farmer panel. This experience builds on and integrates the information gained from their basic science courses at the university.

Pan American Agriculture School in Zamorano, Honduras: This practical school combines half days of field labor and work experiments with crop/animal management with half days of classroom study. This continual integration of the practical with the theory has turned out many of the most sought-after young people in Latin America. The new EARTH school in Costa Rica is patterned after the model in Zamorano.

Washington State Community College: There is a new integrative program in one of the community colleges in a predominantly fruit growing area that includes formal courses in the classroom plus substantial time in practical field work directly with growers. Students follow an apprenticeship during their last year, and this is such an important program to growers in the area that many students are paid to go to school for the last year of studies in exchange for two years' agreement to work for a certain company or farm.

Washington State University: The environmental studies program in initiating graduate study for individuals who want to work across the traditional department lines. Students help to design their own course of study, and the supervisory committee is made up of people from several departments.

### Directions for the future

In summary, there are some successful models around, and much to learn about education in agricultural systems. The workshop participants pointed out that:

- \* we need to provide basic courses in specific topics, but sustainable agriculture must be integrative; we must provide some of those linkages
- \* it is not possible to achieve that integration without systems thinking; integration is harder than building the pieces
- \* it may be necessary to break down or drastically alter some current educational structures; the most palatable way to do this may be to provide alternatives within the current universities
- \* monetary incentives may be critical to reshaping the curriculum; support for innovative, experiential, well-planned educational experiences will attract students and faculty
- \* there is no duality between content-based, specific knowledge and integrative approaches; both are needed and complement each other
- \* doing one or two seminars or courses on systems is not enough to create a viable systems curriculum; more change is needed.

Discussion Session, October 26, 1993, Science & Sustainability Meeting, Bellevue, Washington

Charles Francis, Moderator  
 Nancy Grudens Schuck, Recorder  
 Lisa Huyck, Recorder

# **SUSTAINABLE AGRICULTURE EDUCATION: A PANEL**

**Developed by:**

**Susan Small, Ted Bartlett, Louise Warner, Jim  
Fleming, Rory Lewandowski, Don Olson, Dorthy  
Brazis, Dennis Baker, Merideth Wessells, Ben  
Stinner, Brad Brummond, and James King**

**Audience:** Educators interested in an overview of  
instructional concerns related to sustainable  
agriculture

**Objective:** To present issues related to education and  
sustainable agriculture

## **SUSTAINABLE AGRICULTURE EDUCATION: A PANEL**

### **OVERVIEW:**

This panel discussion centered (a) on what should be taught to whom, in an academic sense, and (b) on getting practitioners of sustainable agriculture to help in the total educational effort. Audiences for both formal and non-formal educational environments were discussed. Issues such as life-long learning, technology dissemination, and distance learning were not discussed; rather they were subsumed in other content and process issues. Pedagogical focus was on learning and associated processes, incorporating critical thinking, problem solving, and systems perspectives. To realize the goal of a broad educational thrust toward sustainability, several issues are critical -- coalition building, starting where people currently are, on-farm and hand-on type educational efforts, and farmer involvement in all aspects of the educational process.

### **1. GENERAL GOALS FOR SUSTAINABLE AGRICULTURE EDUCATION INCLUDE:**

1. The need for those in the sustainable agriculture movement to listen to all agricultural actors and organizations, and to become facilitators, not directors, of a participatory and very broad educational process;
2. The need to connect groups and individuals, through a variety of networking techniques and processes. Through participatory educational processes, understanding of sustainable agriculture concepts and goals can be built;
3. The need to get all those involved in agriculture to think about the change process and the changing concepts of sustainable agriculture. There is a need to plant an intellectual seed in their minds so they can define the context of learning. There is a need to let individuals decide about specific sustainable agricultural changes they will undertake in their own lives, jobs, organizations, and/or farms;
4. The need to be able to communicate carefully, finding out where information is, access it equitably, and make it available;
5. The need to recognize individual and organizational differences, and to develop strategies to bring groups together.

### **2. SPECIFIC GOALS FOR SUSTAINABLE AGRICULTURE EDUCATION INCLUDE:**

1. The participants in sustainable agricultural education will be able to locate and retrieve pertinent information for their particular questions and concerns;
2. The participants in sustainable agricultural education will be able to recognize and describe the current status of contemporary agriculture;

3. The participants in sustainable agricultural education will be able to describe current concepts and practices of sustainable agriculture;
4. The participants in sustainable agricultural education will be able to improve the environment;
5. The participants in sustainable agricultural education will be able to do things differently (compare to what they are doing now) to improve the quality of life.

### **3. AUDIENCES AND PARTICIPANTS IN SUSTAINABLE AGRICULTURAL EDUCATION WILL INCLUDE:**

1. Undergraduate students in universities -- for both classroom and on-farm experiences.
2. Graduate students
3. Farmers and ranchers
4. K-12 students (elementary and high schoolers)
5. Adults, general public
6. County extension staff
7. University faculty -- including researchers
8. Researchers
9. University administrators
  - a. The focus is on both formal and non-formal education, with farmers being involved as part of multi- and interdisciplinary teaching teams, designing as well as guiding learning.
  - b. This audiences and participant list is not in a rank order.

### **4. UNDERGRADUATES:**

1. The educational process has to be reinvented and made less top down. The question "Who does this education and information serve?" must continually be asked.
2. Farmers and farm groups must be involved in the formal education process as nontraditional teachers.
3. As part of their educational experience, students must get out of the traditional classroom. Example options include (a) internships on a working, sustainable farm, and (b) cooperative arrangements with farms. Depending on particular situations, students would earn credit; farmers would be paid.
4. Sustainable principles should be integrated and incorporated in current production practices classes. However, developing autonomous programs in sustainable agriculture should be explored for some institutions. Depending on the particular organizational context, a stand-alone program in sustainable agricultural systems might be more advisable and expedient.

5. Older texts and materials now housed in libraries and which emphasized basic production practices should be considered for inclusion in conventional classes. Such materials could be gathered into specialized libraries or readings. These materials would present a balance of basic information in conventional, production classes. The content of this balance of materials might include, for example, earthworms in soil fertility, organic matter, and biological control.
6. Applied principles of sustainable agriculture, which could be used in larger systems, should be taught in courses.

## **5. FARMERS:**

1. Teaching methods for farmer education should (a) move away from one-way flow of information, the teaching/extension/university to the farmer model, to (b) an interactive and participatory learning model in which all groups share information, farmers are acknowledged as important holders of knowledge, and the teaching/extension/university becomes a facilitator of learning experiences.
2. Farmers want to know where to go for information on sustainable agriculture, and how to find that information.
3. Information on sustainable agriculture should be made more available. For example, information on sustainable agriculture could be put in "fact sheet" form. Content for these "fact sheets" should explicitly state the contexts of particular operations.
4. Farmers should be part of a team writing "fact sheets" about sustainable agriculture.
5. Farmers should be part of curriculum development teams.
6. When compared to non-farmers, practicing farmers are more credible sources of information on sustainable farming practices for other farmers.
7. Farmers should be brought together and offered mentoring opportunities.
8. General ecological education should be offered to farmers.

## **6. K-12 STUDENTS:**

1. Long-range educational strategies about sustainable agriculture mean that we should start the educational process very early.
2. Children should learn broad ecological principles.
3. Learning processes should include field trips, on-farm working experiences during the summer, weekend family tours.
4. Learning situations and environments should be created where youth feel safe to learn new things.
5. Informal, hands-on techniques will prevail as teaching methods.
6. Parents and families should be involved in the educational process. Thus, parents and families should be included in on-farm trips and activities.

**7. EXTENSION STAFF, UNIVERSITY FACULTY:**

1. Universities must change themselves for the staff to change.
2. People should be trained to use the Sustainable Agriculture Network on the Internet to gather information and network with both like and dislike interests.
3. Farmers and producers need to help Extension staff and university faculty learn to think in sustainable agricultural terms, i.e., processes, systems, preventative. This change will move faculty from recipe thinking - technical answers to questions - to more participatory modes. One model will be to talk about specifics of sustainable agriculture while letting the principles of sustainable agriculture emerge from the discussions and observations. See No. 9 below.
4. Producers should be involved to help teach sustainable agriculture.
6. Sabbaticals to work on-farm should be offered to faculty as an alternative experience.
7. Multi-disciplinary teams need to focus on sustainable agriculture topics.
8. The economics of sustainable agriculture must be discussed. Methods of sustainable agriculture should be shown which will be profitable for production.
9. One new teaching-learning model will be to talk about the specifics of sustainable agriculture, allowing time and circumstances to let the principles of sustainable agriculture emerge from conversation and observation, in a non-threatening manner.

**8. ADMINISTRATION, AND ACADEMICS AND UNIVERSITIES:**

1. University administration and academics must be told continuously what is happening with sustainable agriculture, and what the concerns of the people are. Universities and administrators must change themselves for the faculty to change.
2. Avenues to administrators are through faculty, farm groups, and advisory councils.
3. Farmers themselves need to talk to administrators and department chairs.
4. Different groups interested in sustainable agriculture must cooperate to get University department chairs involved with sustainable agriculture. Department heads can be taken to visit selected sustainable agricultural farms, and to meet with selected farmers. Arrangements will be made and coordinated with local sustainable agricultural groups.
5. Information on sustainable agriculture grants should be focused on departments. This would allow departments to change direction, within the existing system.



## **9. CONCLUSIONS:**

Currently, we are living between paradigms, moving toward creating a nurturing environment. We have to keep our paradigms open to alternatives. We have to educate our educators.

Soils are one of our most precious resources. Therefore we have to work on changing farm policy to emphasize the proper use of soil.

We must get farmers into classrooms. We must strive to move student out of the classroom and onto farms which model sustainable systems. An industry strategy would be to set up internships in sustainable agriculture, sponsored by industries. The internship-industry linkages would build trust, and would become models for other type of programs and organizations.

All of us involved in sustainable agriculture are co-learners. We need to network better and to move information more quickly.

Finally, we must advance beyond confrontation. Together, we can work toward the goal of sustainable systems.

Discussion Group and Panel: Susan Small, Ted Bartlett, Louise Warner, Jim Fleming, Rory Lewandowski, Don Olson, Dorthy Brazis, Dennis Baker, Merideth Wessells, Ben Stinner, Brad Brummond (Recorder), James King (Moderator).

Discussion at the North Central Region Sustainable Agriculture Workshop in Columbus, Ohio, August 17, 1993.

# **IMPACT OF SUSTAINABLE AGRICULTURE PROGRAMS ON U.S. LAND GRANT UNIVERSITIES**

**Developed by:**

**Charles Francis, Clive Edwards, John Gerber,  
Richard Harwood, Dennis Keeney, William  
Liebhardt, and Matt Liebman**

**Audience:** Educators interested in sustainable agriculture

**Objective:** To describe several university efforts in  
sustainable agriculture

To show approaches to sustainable agriculture  
education which could be adopted



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### **Impact of Sustainable Agriculture Programs on U.S. Land Grant Universities**

by

Charles Francis, Clive Edwards, John Gerber, Richard Harwood,  
Dennis Keeney, William Liebhardt, and Matt Liebman<sup>1</sup>

#### **Introduction**

Agriculture in the U.S. and elsewhere is in a period of transition toward reduced inputs and lowered costs, as well as toward more efficient use of resources and less negative impact on the environment (Poincelot, 1990). In response to an emerging concern about natural resources, environmental, economic, and social dimensions of agriculture, a number of land grant universities have launched programs in sustainable agriculture. The motivation for this initiative has come from university faculty, from individuals and farmer groups, from people with environmental concerns, and often from scientists who have international experience in cropping and animal production systems. Some of the motivation is related to newly available sources of support for research and education programs (Bird, 1992; Madden *et al.*, 1992).

The public research and education system is charged with dual roles of pursuing scientific truth and learning while responding "to public demands, needs and criticisms" (Danbom, 1992). Although these two roles are not necessarily in conflict, they do represent what we often contrast as basic versus applied research, and theoretical versus practical education. Another dimension of integration is shown in the current interest to blend the methods and results of studies in ecology with those of agriculture in the university curriculum (Altieri and Francis, 1992). One of the most active new dimensions of practical field research and

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<sup>1</sup>C. Francis, Dir. of Center for Sustainable Ag. Systems, U. Nebraska; C. Edwards, Entomology Dept., The Ohio State U.; J. Gerber, Dir. of Extension, U. Massachusetts; R. Harwood, Crop and Soil Sci. Dept., Michigan State U.; D. Keeney, Dir. of Leopold Center, Iowa State U.; W. Liebhardt, Dir. of UC Sustainable Ag. Rsch. and Ext. Pgm., U. California, Davis; M. Liebman, Plant Sci. Dept., U. Maine. A summary of this paper was presented at the American Society of Agronomy Annual Meeting, Minneapolis, 1992.



extension is on-farm research which is growing rapidly within the land grant university agenda (Gerber, 1992). These several directions are helping the land grant system to work more closely with a number of players in the agricultural sector, taking advantage of new information and other resources. Programs within the land grant universities have taken different forms, with emphasis on new research initiatives, on classroom teaching, and on extension programming. We surveyed a large sample of administrators and faculty from the U.S. land grant system to determine what impacts they perceived of sustainable agriculture programs on their research, teaching, and extension programs. This paper identifies current university efforts in sustainable agriculture and provides several approaches to how the land grant system could accelerate these efforts in the near future. In addition to the survey results, several university programs were summarized in more detail. Finally, the potentials for cooperative activities among states and a number of future directions are explored.

## **Survey of U.S. Land Grant Programs**

### **Survey Methodology**

A mail survey was sent to three groups in the land grant universities: agricultural administrators, random group of faculty, and faculty known to be interested (by previous publications, attendance at workshops, or personal communications) in sustainable agriculture. Two names were chosen in each of these categories from the 1991-92 Directory of Professional Workers in State Agricultural Experiment Stations (USDA, 1992). Survey forms were sent in August, 1992, and no reminders were sent. Of the 100 surveys sent to each group, there were differences in rate of return among administrators (49%), random faculty sample (40%), and faculty with known interest (66%). Results were summarized and presented at the 1992 Annual Meetings of the American Society of Agronomy in Minneapolis (Francis *et al.*, 1992).

We asked this overview question: "Please evaluate the impact that sustainable agriculture programs have made on various activities in your university in recent years, and include examples of projects or programs under way." Separate questions asked about the impact on research, on teaching, on extension, and on the overall program in agriculture. Respondents were asked to rank the impact from 1 (minimal) to 9 (major) on each program. At the end of the form, we asked for a list of specific projects and activities, and a number responded with printed material on their programs. A major limitation of the survey is lack of specific data on faculty FTEs and total budgets dedicated to sustainable agriculture programs. This information is difficult to obtain.

### **Survey Results**

The respondents suggested that the largest impact was on extension and research programs and the least impact was on classroom teaching (Table 1). On the average, administrators have observed a greater impact of these programs than have the interested faculty and the random faculty group. There was a difference among respondent groups and specific activity area was revealed by the data on responses. Administrators and random faculty respondents felt that the greatest impact was on extension and the least on teaching. The interested

faculty respondents felt that the greatest impact was on research, much more than on teaching. We offer no suggestions as to why this interaction occurred.

When respondents' information was aggregated by region (Northeast, North Central, Southern, Western) using the traditional USDA classifications by states, there were clear differences among the regions (Table 2). The perceived impact of sustainable agriculture programs appears to be greatest in the Northeast region, and least in the Southern and North Central Regions, with the Western region intermediate in response. In this case there was no interaction between region and specific activity, with the Northeast region having the highest ratings for all questions and the Southern region having the lowest ratings across the U.S. Information on the ratings in both tables was supported by the additional comments of respondents at the bottom of the forms and by the supplementary materials sent with the forms. There was a clear emphasis on extension programs that was greater than that on research or on classroom teaching. There were remarkable exceptions to this, for example the teaching program at the University of Maine, and these are discussed in detail in the section on specific university programs.

Equally useful were the specific comments written on the survey forms that revealed the diversity and innovation that is being introduced across the country in new programs. A number of respondents gave these examples of programs that were important in their evolving curriculum and research/education agenda:

- Sustaining natural resource productivity was identified as high priority in survey results in Wyoming, and is causing change in direction of programs (U. Wyoming).
- A course offered to all first year students, "Perspectives in Agriculture and Associated Natural Resources," has a large emphasis on sustainability (U. Tennessee).
- Increased dialog with groups representing sustainable agriculture interests, a new faculty position in resource efficient cropping systems and one in rural sociology, and a Center for Sustainable Agricultural Systems were implemented (U. Nebraska).
- A research program on novel cropping systems approaches, new crops research, and major new initiatives in aquaculture for alternative farming systems are in place (U. Maryland).
- Sustainable agriculture means not only a concern for what we grow, but how we grow it and what the consequences of those decisions are for the future (U. Maine).
- Biocontrol of weeds and Russian wheat aphid, soil transport of chemicals, crop rotation studies, as well as more work to build coalitions on the environment are important (Colorado State U.).
- Biocontrol of pests for all crops, low chemical inputs for plantation fruit crops, and studies of economic sustainability have been initiated (U. Hawaii).
- Social and cultural factors affecting sustainable agriculture and barriers to adoption, and integrated crop/livestock systems are part of our program (U. Illinois).
- An extension program on composting, lawn watering advice, research on low-input turf management, and an experimental course on sustainable systems are part of our current agenda ((U. Rhode Island).
- A research/extension farm for sustainable agriculture, undergraduate courses, whole farm vegetable systems development, and co-sponsoring of county fair exhibits are new for us (Rutgers U.).

### **Profiles of Selected Programs**

From the information assembled on our own universities' activities in sustainable agriculture, we have summarized seven programs in outline form accompanied by a short description of each of these innovative initiatives.

#### **Profile: Iowa State University**

With one of the most effective centers for sustainable agriculture, Iowa State University has pioneered in the establishment of a research and extension program in this area. Strong financial support from a fertilizer/chemical check-off in Iowa, energy overcharge funds, and legislative appropriations have been instrumental in the success of the Leopold Center. Research activities have been organized through a series of "issue teams," and a comprehensive educational program is now run by an education coordinator for the Center. The Practical Farmers of Iowa has a coordinator for on-farm research who is an adjunct member of Cooperative Extension, and is housed in the Agronomy Department. Joint efforts in field days and a new "train the trainer" workshop were accomplished in 1992. The annual conference and written reports of the Leopold Center are models for others to emulate.

#### *Iowa State University*

- Leopold Center for Sustainable Agriculture
- Competitive grants around Iowa focused on key research issue areas
- Workshop series on biological and sustainable agriculture
- National satellite broadcast of sustainable agriculture course
- Production of video series on sustainable practices
- Close working relationship with Practical Farmers of Iowa

#### **Profile: University of Maine**

Among land grant universities, University of Maine has led the way in development of courses and curricula in sustainable agriculture. With an impressive cadre of faculty associated with the Sustainable Agriculture Research Group (SARG) and with the teaching of a range of courses, the university has pioneered systems research in the field and innovative classes on campus. In addition to the B.S. degree program in sustainable agriculture, Maine offers graduate degrees (Master of Professional Studies, M.S., Ph.D.) in ten different areas. The faculty is especially strong in the areas of IPM and biological control, insect ecology, plant-soil interactions and cover crops, water quality and conservation, design of new systems, and economic analysis of farming systems and off-farm impact. The Assistant Vice President and Station Director has been a strong supporter of sustainable agriculture activities for the past decade.

#### *University of Maine*

- Undergraduate and graduate curriculum in sustainable agriculture
- Systems courses including agroecosystem analysis and design
- Rogers Farm, a Sustainable Agriculture Research Center near Stillwater, Maine

- Potato cropping systems research in cover crops, fertility, economics
- Strong support from university administrators

**Profile: Michigan State University**

The W. K. Kellogg Biological Station has long fostered team research on ecological issues, and the long-term ecological research site is one of a nation-wide network of locations where this research is taking place. The program in sustainable agriculture at Michigan State University has accelerated with the organization of the C.S. Mott Chair position and with a number of related research activities in IPM, crops and soils, resource economics, and other areas. In IPM there is a focus on reduced chemical approaches to plant protection, on landscape ecological enhancement to regulate insect and weed populations, legume management for VA mycorrhizal enhancement in potato systems, and sustainable tomato production systems. Biological enhancement research includes nutrient cycling and availability, vegetative cover studies, management of forage-based systems, crop/livestock integration, manure handling, and long-term rotation studies. There is a close working relationship with the Michigan Agricultural Stewardship Association.

*Michigan State University*

- Long-term ecological research in cropping and crop/animal systems
- Center for Microbial Ecology in Crops and Soil Sciences Department
- Composting applications and research program
- Agricultural biotechnology for sustainable productivity program
- Biological integration and modeling of systems integration
- C.S. Mott Chair of Sustainable Agriculture and fellowships with position

**Profile: University of Illinois**

The University of Illinois has pursued an aggressive program in sustainable agriculture, with focus on long-term issues of environmental impact and profitability. Dr. Harvey Schweitzer was the first coordinator for sustainable agriculture, and he has reviewed the current initiatives in conservation tillage, IPM, soil fertility management, and studies of efficiency in cropping and crop/animal systems. Cooperative programs include efforts of farmers, production agriculturists, economists, sociologists, ecologists, and others, in both research and education. In this research, the university considers it important to understand ecosystem relationships to help farmers better manage renewable inputs and processes to seek productivity, sustainability, stability, and social equity.

*University of Illinois*

- National conference on methods for on-farm research
- Agro-Ecology news and perspectives and program paper series
- Focus on environmental and social aspects of agriculture
- Symposia on campus and seminar series with outside speakers
- New courses in agroecology, natural resources, forest systems
- Research with rotations, tillage, grazing systems
- Close collaboration with farmer organizations, on-farm research activities

**Profile: The Ohio State University**

The program at Ohio State University has gained international stature through the two large conferences held in 1988 and 1991, with books published from each of these meetings (1991 in press). The survey work with a large sample of Ohio farmers, the economic evaluation of farm operations, and the comparison of high- and low-input farming have provided a strong information base with which to compare agricultural system alternatives. Research has focused on IPM, soil fertility options, field crop, vegetable, and fruit production systems. A manual is being written to outline the transition to systems that conserve both on- and off-farm energy resources. There is a student internship program, a series of seminars and workshops on sustainable agriculture, and a growing interest in evaluating existing courses and considering new offerings in the curriculum.

***Ohio State University***

- International conference on sustainable agricultural systems
- Research on farmer input use, farming systems, environmental dimensions of farming
- Demonstration farm at Reynoldsburg with Ohio Dept. of Agriculture
- Nutrient cycling, ridge tillage, weed management research
- Quarterly meetings and newsletter for farmers, SCS specialists, other clients
- Farmer/mentor program, in-service training, farmer directory
- International conference on agriculture and the environment

**Profile: University of California, Davis**

As a result of California legislation passed in 1986, the Sustainable Agriculture Research and Education Program was developed at the University of California-Davis (UC SAREP). UC SAREP has three main responsibilities: administration of competitive research grants, development and distribution of information, and establishment of long-term farmland research sites. With some funding from the legislature and strong support in land acquisition from the university, this program has moved rapidly over the past six years. The competitive grants program has attracted substantial interest both on campus and around the state. Educational programs and in-service training have been part of the outreach effort. Workshops with SCS and other government agencies have built the teams necessary to put integrated efforts together in the field. The newsletter and progress report have brought valuable information to the public to build more support for these activities.

***University of California, Davis***

- Competitive grants program in research, education, demonstration
- Sustainable Agriculture Research and Education Program (UC SAREP)
- Information development and distribution, conferences, workshops
- Sustainable agriculture news, national bulletin board/network
- Long-term research on agricultural systems, crop diversity, water use efficiency
- Active extension programs, inter-departmental teaching on systems in agriculture



**Profile: University of Nebraska**

A national symposium on sustainable agriculture and natural resources was organized in July 1990, with over 300 people attending and a widely distributed proceedings. In late 1990 the University of Nebraska established the Center for Sustainable Agricultural Systems in late 1990, which has strong administrative support for activities in designing future systems for the state. The guiding objective of the Center is to introduce the philosophy of sustainability into the research, teaching, and extension programs of University of Nebraska. The latest vision statement of the Institute of Agriculture and Natural Resources states: "IANR is dedicated to providing the highest quality programs that are ecologically sound, economically viable, socially responsible, and scientifically appropriate." A prototype integrated farm for research and demonstration is bringing together animals, crops, agroforestry, and people at the Agricultural Research Development Center near Mead, Nebraska. Workshops and seminars have been sponsored in collaboration with the National League of Women Voters, USDA-SCS and CSRS, and EPA, as well as various groups within the state. There is a close working relationship with the Center for Rural Affairs and the Nebraska Sustainable Agriculture Society. The University of Nebraska Press has initiated a major book series and will publish the first five titles in 1993.

***University of Nebraska***

- National conference on sustainable agriculture & natural resources
- Established Center for Sustainable Agricultural Systems
- Integrated crop/livestock research & demonstration farm at ARDC, Mead
- Seminar series on designing the 1995 Farm Bill
- Workshop with League of Women Voters on planning for the future
- Extension priority task force on sustainable agriculture
- Integrated crop management in-service training for Extension and SCS
- Publication of "Our Sustainable Future" book series through U. Nebraska Press
- Extensive purchase of relevant books for library, district research/extension centers

**Summary of Current U.S. Programs**

There are many other exemplary programs in the U.S., and a growing number of universities that are just establishing centers or working committees to pursue this direction in sustainable agriculture. Each of the programs is unique to the local research, education, and farming environment. There are strong components in each of these programs. Most are seriously hampered by lack of identified funding for center or committee operation. Some universities maintain that this type of work on efficiency of resource use and environmental impact has always been a focus of programs—they tend to devote less energy to this type of identified activity. There is much to learn from these programs, and it is far too early to conclude what the impact has been and will be in the long term as a result of these initiatives.

### **Future Directions for Sustainable Agriculture Programs**

One approach to designing an ideal or prototype university program would be to choose components from each of the current programs, adapt these to a given university environment, and package the components as one program. For example, the following model components could be chosen as part of a comprehensive program that could be started in any state.

#### **Components of a Model Program**

These are some of the most successful and highly visible activities and components from existing state programs, and that could be considered as part of a comprehensive state program designed for the future:

- Administrative organization and staffing on campus office (Iowa, California)
- Comprehensive long-term research program with grant support (Michigan, Iowa)
- Newsletter models (Illinois, Iowa, California, Maine, Nebraska)
- Annual or multi-year reports (Iowa, California)
- Educational curriculum, undergraduate and graduate degrees and faculty (Maine)
- Seminar series (Illinois, California, Nebraska)
- Extension integration with farmer organizations (Nebraska, Ohio, Illinois, Iowa)
- International and national conferences and published proceedings (Ohio, Nebraska)
- Book series published, books purchased for library & extension centers (Nebraska)
- Integration of Practical Farmers of Iowa, Farm 2000 program with Extension (Iowa)
- Demonstration farms (Ohio, Maine, Michigan, Wisconsin, Nebraska)
- National information network, bulletin board (California, National Ag Library)

There is no doubt that a program incorporating most or all of these components and identifying sufficient resources to keep it functioning could make a major contribution to the long-term viability of that state. This is probably a luxury that none of us can afford at this juncture. What are some of the potential solutions? There is no doubt that we have to work together not only within each state, but also across state lines. Some of the potential routes to such collaborative effort follow.

#### **Avenues of Potential Collaboration among Sustainable Agriculture Programs**

In a time of limited funds and personnel, it is highly desirable to think about how these resources could be shared and brought into focus on areas of several states or entire regions. There is currently a high level of communication among programs in each region of the U.S., and it is easy to imagine a close collaboration on some joint projects. These might include:

- Design collaborative research programs and share results (USDA's SARE Program)
- Multi-state and multi-agency in-service training (ICM Workshop, IA, KS, MO, NE)
- Develop national curriculum for classroom, in-service education (North Central Region)
- Publish through Amer. J. Alt. Agr., J. Sustainable Agr., U. Nebraska Press Series
- Cooperate on newsletters, annual reports, literature collections, bulletin boards
- Participate in electronic mail groups like Sustainable Agriculture Network on Internet

- Use satellite broadcasts for seminars, courses, conferences, training
- Conduct multi-state station and on-farm research, share methods, analyses, results

These are some of the ways in which programs with limited budgets could work together to get the most benefit from limited available resources. A good topic for a future symposium on sustainable agriculture would be: In addition to pooling resources for joint programs today, what are some of the potential future directions for these programs?

### **Potential Future Directions for Sustainable Agriculture Programs**

What has been summarized represents the current state of the art, the present level and type of activities that are under way in U.S. state-specific programs. We need to explore what some of the future directions might be in resource efficient agriculture as an important part of a sustainable development strategy. Some changes could include:

- Expand current activities by increased funding to SARE (LISA/ACE) grants
- Build new coalitions with environmental and consumer groups to increase funding
- Attract private industry support by searching for new products and services
- Integrate activities into mainstream/conventional research and education agenda
- Enlist commodity group support for research and education activities
- Develop more effective information sharing networks, fast access to results
- Build a coalition of private foundation sources interested in sustainable development
- Establish a mechanism for sharing ideas and resources among centers in land grants

These are some potential future directions. It would be useful to convene a group of people who have been through the phases of conceptualizing and initiating committees and centers of sustainable agriculture to share approaches, successes and problems of institutionalizing goals and activities. There are some exceptionally successful programs in a number of land grant universities, and we could all learn from these well organized models. There is little doubt about the importance of the move toward more resource efficient and environmentally sound agriculture. Questions remain about how this can best be achieved, and how the land grant universities can best contribute to the process. As we focus more attention on total farm systems, on communities and watersheds, and on the total rural environment, there is little question about the relevance of sustainable agriculture programs that can contribute to this process. We do need to learn from each other, to share ideas and resources, and to make the greatest possible use of limited resources. Such an approach will lead to even greater impact of sustainable agriculture programs in the land grant universities.

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**Table 1.** Average Rating ( 1 = low, 9 = high) of Impact of Sustainable Agriculture Programs on University Activities as Evaluated by Three Groups of Respondents in National Survey, 1992<sup>1</sup>

Impact on programs in these areas	Respondents (number in group)			
	Administrators (46)	Random Faculty (37)	Interested Faculty (63)	All Groups (146)
Research	5.5bc	4.9bc	5.7ab	5.4x
Teaching	4.7cd	4.7cd	4.6d	4.7y
Extension	6.4a	5.2bcd	4.9bcd	5.5x
Overall	5.7ab	4.9bcd	5.2bcd	5.3x
Average Impact	5.6m	4.9n	5.1n	5.2

<sup>1</sup> Average ratings followed by same letter in center block (lsd = 0.85), in bottom line (lsd = 0.49), or in right column (lsd = 0.42) do not differ significantly ( $\alpha = 0.05$ ).

**Table 2.** Average Ratings ( 1 = low, 9 = high) of Impact of Sustainable Agriculture Programs On University Activities as Evaluated in Form Geographic Regions in National Survey, 1992<sup>1</sup>

Impact on programs in these areas:	Region (number in group)				
	West (32)	North Central (43)	South (40)	North East (31)	All Groups (146)
Research	5.3cdef	4.9defgh	4.6efghi	6.7a	5.4x
Teaching	4.5fghi	4.1hi	3.9i	6.1abc	4.7y
Extension	5.5bcde	5.2cdefg	4.6efghi	6.7a	5.5x
Overall	5.7bcd	4.8defghi	4.3ghi	6.4ab	5.3x
Average Impact	5.3n	4.8σ	4.4σ	6.5m	5.2

<sup>1</sup> Average ratings followed by same letter in center block (lsd = 0.98), in bottom line (lsd = 0.49), or in right column (lsd = 0.42) do not differ significantly ( $\alpha = 0.05$ )

# **EDUCATION AND SUSTAINABLE AGRICULTURE: AN OVERVIEW BIBLIOGRAPHY**

**Developed by:  
James W. King and Charles A. Francis**

**Audience:** Teachers, Extension, SCS, and ASCS  
professionals

**Objective:** To provide a bibliography emphasizing  
education and sustainable agriculture

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# **SUSTAINABLE AGRICULTURAL SYSTEMS: A BIBLIOGRAPHY FOCUSED ON IPM, WEED CONTROL, AND SYSTEMS**

**Developed by:  
Clive A. Edwards**

**Audience:** Teachers, Extension, SCS, and ASCS  
professionals

**Objective:** To provide an overview of research reading to  
integration in sustainable agriculture

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